Appendix A

Emissions Estimation Methods For Selected Source Categories

Appendix A presents the emissions estimation methods and references used for each source category for which estimates are based partially or entirely on: (1) non-TRI data, and /or (2) modified TRI data. The documentation is presented alphabetically by source category name. Sources of non-TRI data include MACT development programs, EPA and industry reports, and trade associations. For the source categories in Appendix A that are only partially based on non-TRI data, some of the estimates are from TRI and were extracted using SIC Codes. These include:

- Aerospace Industries;
- Asphalt Concrete Manufacturing;
- Asphalt Roofing Manufacturing;
- Boat Manufacturing;
- Clay Products Manufacturing;
- Electrometallurgical Products Manufacturing;
- Inorganic Pigments Manufacturing;
- Lime Manufacturing;
- Miscellaneous Organic NESHAP;
- Pharmaceuticals Production;
- Plastic Parts and Products Surface Coating;
- Primary Aluminum Production;
- Primary Battery, Dry and Wet Manufacture;
- Primary Lead; and
- Wood Preserving.

This appendix does not provide documentation for source categories with estimates based <u>entirely</u> on unmodified TRI data. These source categories appear in Appendices B and C.

Although this appendix also describes estimation of both Section 112(k) and non-112(k) HAPs, Appendices B and C will only present TRI data for Section 112(k) HAPs.

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Methodology:

The estimate for this source category was provided by U.S. EPA/ESD. There are 4 facilities that produce acrylic fibers/modacrylic fibers and emit acrylonitrile (Wayne, 1997):

Facility	Location	Emissions	State FIP	County FIP
Amoco Polymers	Greenville, SC	20.2 tpy	45	045
Sterling	Milton, FL	53.45 tpy	12	113
Monsanto	Decatur, AL	74.8 tpy	01	103
Hexcel	Decatur, AL	1.34 tpy	01	103
TOTAL		149.79 tpy		

References:

Wayne, T. U.S. Environmental Protection Agency, Emission Standards Division. Personal communication with R. Billings, Eastern Research Group, Inc. Emission estimates and facility locations for Acrylic Fibers / Modacrylic Fibers Production. August 8, 1997.

Methodology:

The total national estimates from both major and area source facilities were speciated to individual HAP estimates through guidance from EPA memoranda.[1-6] Depainting, Chemical Milling Maskant, Spray Gun Cleaning, Hand-wipe Cleaning, and Primer and Topcoat Operations are the main processes for HAP emissions under the Aerospace Industries MACT. The following table outlines how the total HAP estimates were derived:

Total HAPs Emitted (tons HAP/year)

Plant Size	Primer and Topcoat Operations (Ref. 5)	De-painting (Ref. 1)	Chemical Milling Maskant (Ref. 3)	Spray Gun Cleaning (Ref. 3)	Hand-wipe Cleaning (Ref. 4)	Inorganic HAPs (Ref. 2)	Total
Small Commercial	701	602	Not Applicable	395	5,799	0.07	7,687.07
Small Military	190						
Medium Commercial	1,853	4,862	2,262	613	177,828	0.16	188,900.16
Medium Military	1,482						
Large Commercial	178	333	1,099	9	9,396	0.02	11,176.02
Large Military	161						
Total Major (Ref 1-5)	4,565	5,797	3,361	1,017	193,023	0.25	207,763.25
Total Area (Ref 6)							7,779
Total HAP Estimate							215,542.25

A table illustrating the speciated HAP estimates for the above non-TRI estimates are provided on the next page. The remaining HAP estimates for Aerospace Industries were taken from the TRI database[7] based on the following SIC Codes: 3724 (Aircraft Engines And Engine Parts), 3721 (Aircraft), 3728 (Aircraft Parts And Equipment, Nec).

References

1. U.S. Environmental Protection Agency. National Emission Standard For Hazardous Air Pollutants (NESHAP) for the Aerospace Industry - Background Information for Proposed Standards. Preliminary Draft. Research Triangle Park, NC. April 1994.

2. Hendricks, David. Pacific Environmental Services, Inc. Memorandum to Vickie Boothe, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. "Nationwide Environmental Impacts for the Control of Primer and Topcoat Inorganic Emissions, Depainting Inorganic Emissions, Wastewater Emissions, Storage Tank Emissions, and Waste Emissions." February 15, 1994.

3. Memo from Dave Reeves, Midwest Research Institute to Barbara Driscoll, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards regarding HAP emission estimates for aerospace surface coating. November 11, 1997.

4. Memo from Dave Reeves, Midwest Research Institute to Barbara Driscoll, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards regarding HAP emission estimates for aerospace surface coating. November 17, 1997.

5. Telephone conversation between Dave Reeves, Midwest Research Institute and Bridget Kosmicki, Eastern Research Group. Subject: Emissions from aerospace surface coating. November 18, 1997.

6. Driscoll, B., U.S. Environmental Protection Agency, Planning, Policy, and Standards Group. Memorandum to A. Pope, U.S. EPA. "Area Source Emissions for the Aerospace Industry." October 27, 1998.

7. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

Emissions from Aerospace Industries (Surface Coating)

EPA provided national solvent usage for Hand-wipe Cleaning at Major facilities. Using this information, a HAP Speciation Profile for Handwipe Cleaning can be calculated:

HAP	Solvent Usage (gallons)	% HAP
16-PAH (Naphthalene)	6,894	0.8%
Benzene	56	0.01%
Glycol Ethers	5,497	0.7%
Hexane	6,203	0.8%
Methanol	445	0.1%
Methyl Chloroform	95,386	11.7%
Methyl Ethyl Ketone	509,886	62.7%
Methyl Isobutyl Ketone	6,639	0.8%
Methylene Chloride	50,430	6.2%
Tetrachloroethylene	736	0.1%
Toluene	69,206	8.5%
Trichloroethylene	54,749	6.7%
Xylene	7,229	0.9%
Total	813,356.00	100.00%

The process-level information provided by EPA are for Major Source facilities. However, because a national area source estimate was provided (7,779 tpy), the total Area source process-level information can be estimated using a scaling factor:

Process	Total HAP Estimate from Major Sources	Scaling Factor	Total HAP Estimate from Area Sources	Total HAP Estimate (Major and Area)
Depainting	5,797.00	0.0374	217.05	6014.05
Chemical Milling Maskants	3,361.00	0.0374	125.84	3486.84
Spray Gun Cleaning	1,017.00	0.0374	38.08	1055.08
Hand-wipe Cleaning	193,023.00	0.0374	7227.10	200250.10
Primer and Topcoat Op.	4,565.00	0.0374	170.92	4735.92
Inorganic HAPs	0.25	0.0374	0.01	0.26
Total HAP	207,763.25		7779.00	215542.25

Example Calculation: Methlyene Chloride Total Estimate = (100%*6014.05 tpy Depainting)+(6.2%*200,250.10 tpy Hand-wipe Cleaning)
Methlyene Chloride Total Estimate = 18,430 tpy

HAP	Depainting	Chemical Milling Maskant	Spray Gun Cleaning	Hand-wipe Cleaning	Primer and Topcoat Op.	Inorganic HAPs	Total HAP Estimate (Major)	Total HAP Estimate (Area)	Total HAPs (tpy)
1,4-Dioxane					4%		182.60	6.84	189.44
16-PAH (Naphthalene)				0.8%			1,636.06	61.26	1,697.32
Arsenic Compounds						1%	0.00	0.00	0.0026
Benzene				0.01%	4%		195.89	7.33	203.22
Cadmium Compounds						1%	0.00	0.00	0.0026
Chromium Compounds						90%	0.23	0.01	0.2334
Cobalt Compounds						1%	0.00	0.00	0.0026
Ethyl Benzene					10%		456.50	17.09	473.59
Formaldehyde					4%		182.60	6.84	189.44
Glycol Ethers				0.7%	4%		1,487.13	55.68	1,542.81
Hexane				0.8%			1,472.08	55.12	1,527.19
Lead Compounds						5%	0.01	0.00	0.0130
Mercury Compounds						1%	0.00	0.00	0.0026
Methanol				0.1%			105.61	3.95	109.56
Methyl Chloroform				11.7%	4%		22,819.30	854.39	23,673.69
Methyl Ethyl Ketone		7%	9%	62.7%	10%		121,788.71	4,559.97	126,348.68
Methyl Isobutyl Ketone		7%		0.8%	10%		2,267.32	84.89	2,352.21
Methylene Chloride	100%			6.2%			17,764.88	665.15	18,430.03
Nickel Compounds						1%	0.00	0.00	0.0026
Tetrachloroethylene		50%		0.1%			1,855.17	69.46	1,924.63
Toluene		25%	11%	8.5%	25%		18,520.81	693.45	19,214.26
Trichloroethylene				6.7%			12,992.85	486.47	13,479.33
Xylene		11%	80%	0.9%	25%		4,035.50	151.10	4,186.60
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	207,763.25	7,779.00	215,542.25

Methodology:

Summary of Emission Estimation Method for Animal Cremation

The 1990 national emission estimates for arsenic, beryllium, cadmium, chromium, formaldehyde, mercury, nickel, and POM (as 16 PAH) were developed by multiplying an emission factor by a national activity estimate (see table). Emission factors for these hazardous air pollutants, except formaldehyde, were taken from the State of California Air Resources Board Test Report No. C-90-004 (Reference 1). The emission factor used for formaldehyde was reported in the USEPA FIRE System Database (Reference 2). Emission factors were converted to a pound per ton basis using the procedure provided by the Emission Standards Division (Reference 3). The emission factor for POM (as 7 PAH) was taken from the 112(c)(6) report (Reference 4). National activity was provided by the Emission Standards Division (Reference 3) based on information reported in the 112(c)(6) report (Reference 4).

References:

1. State of California Air Resources Board, Engineering Evaluation Branch, Monitoring and Laboratory Division. "Evaluation Test on Two Propane Fired Crematories at Camellia Lawn Cemetery." Test Report No. C-90-004. October 29, 1992.

2. U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

3. Crume, Richard, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Animal Cremation information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. October 30, 1998.

4. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Nationwide Emissions from Animal Cremation, 1990

Pollutant	Emission Factor (lb/ton cremated)	Emission Factor Reference	National Activity Level (Reference 1, 2) (tons cremated/year)	National Emissions (tons/year)
arsenic	4.00E-04	Reference 2, 3	8.00E+04	1.60E-02
beryllium	1.84E-05	Reference 2, 3	8.00E+04	7.36E-04
cadmium	1.48E-04	Reference 2, 3	8.00E+04	5.92E-03
chromium	3.99E-04	Reference 2, 3	8.00E+04	1.59E-02
formaldehyde	2.89E-09	Reference 2, 4	8.00E+04	1.16E-07
mercury	4.39E-02	Reference 2, 3	8.00E+04	1.75E+00
nickel	5.09E-04	Reference 2, 3	8.00E+04	2.04E-02
POM as 7-PAH	1.03E-09	Reference 1	8.00E+04	4.12E-08
POM as 16-PAH	9.63E-04	Reference 2, 3	8.00E+04	3.85E-02

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Crume, Richard, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Human Cremation information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. October 30, 1998.

3. State of California Air Resources Board, Engineering Evaluation Branch, Monitoring and Laboratory Division. "Evaluation Test on Two Propane Fired Crematories at Camellia Lawn Cemetery." Test Report No. C-90-004. October 29, 1992.

4. U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Methodology:

Summary of Emission Estimation Method for Asphalt Concrete Manufacturing

The 1990 baseyear emission estimates for benzene, chromium, ethylbenzene, toluene, and xylenes were taken from the Toxic Release Inventory database (SIC Code = 2951, SIC Description = Asphalt Paving Mixtures and Blocks, reference 1). "Locating and Estimating Air Emissions from Sources of Lead and Lead Compounds," provided a 1990 emission estimate for lead compounds (reference 2). The base year estimate for polycyclic organic matter as 16-PAH is as reported in the "1990 Inventory of Section 112(c)(6) Pollutants," (reference 3). The estimate for 7-PAH was taken from the 112(c)(6) Inventory (reference 3). The following pollutants were excluded from the baseyear report, based on information supplied by U.S. Environmental Protection Agency (reference 4):

Hydrochloric acid	Asbestos
Cumene	Bis (2-ethylhexyl) phthalate
Styrene	Methyl chloroform (1,1,1-trichloroethane)
Ethylene Glycol	Epichlorohydrin (1-chloro-2,3-epoxypropane)
Dibutyl phthalate.	

References:

1. U.S. Environmental Protection Agency. Toxic Release Inventory 1987-1995 CD ROM (1990 data) database. August 1997. EPA 749-C-97-003. Research Triangle Park, North Carolina.

2. U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Lead and Lead Compounds. Draft Report. Research Triangle Park, North Carolina. July 1996.

3. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

4. Johnson, Mary, U.S. Environmental Protection Agency. "Inventory Info." Email to Darcy Wilson, Eastern Research Group. July 20, 1998.

Methodology:

The estimates for Polycyclic Organic Matter as 16-PAH and 7-PAH were taken from the 112(c)(6) inventory (EPA, 1997).

The remaining estimates are from the TRI database, SIC Code =2952, SIC Description = Asphalt Felts and Coatings.

Reference

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA-749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

Lead

The estimate for lead emissions were taken from the L&E report (U.S. EPA, 1996) for: large and small paint application shops and paint application where no spray booth is used. Lead emissions are controlled by the use of baffle plates, filter pans, and water curtains (U.S. EPA, 1996).

References

U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Lead and Lead Compounds. Draft Report. Research Triangle Park, North Carolina. July 1996.

Methodology:

Aviation Gasoline Distribution

Alkylated lead estimates were taken from the Draft Lead L&E. These alkylated lead values were put in terms of lead based on information in the L&E which noted that for both tetraethyl lead (TEL) and tetramethyl lead (TML), 39.39 percent of alkylated lead is elemental lead.

Reference

U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Lead. Draft Report. Research Triangle Park, North Carolina. February 1997.

Methodology:

All HAP estimates for the Boat Manufacturing source category were developed using 1990 data from the Toxic Release Inventory (TRI) database[1] for two SIC Codes: SIC Code 3731 (Ship Building and Repairing) and 3732 (Boat Building and Repairing)[2] . Using these data, some of the reported estimates were (1) corrected because of known under-reporting in TRI, or (2) adjusted to avoid doublecounting with the Ship Building and Ship Repair (Surface Coating) MACT source category based on guidance from EPA. These adjustments are described below.

Correction of styrene and MMA for known under-reporting

Baseline 1990 estimates for styrene and MMA emissions were under-reported in both SIC Codes 3731 and 3732. The styrene emission factor used by facilities reporting to TRI was off by a factor of two[2]. Therefore, the TRI data reported for styrene were multiplied by two. Because MMA is integral to fiberglass boat manufacturing and typically coexists with styrene, an underestimation of these emissions is assumed and the estimates reported in TRI have been doubled as well.

Adjustments to avoid double-counting with Ship Building and Ship Repair (Surface Coating) NESHAP

According to EPA, the Ship Building and Ship Repair NESHAP addresses emissions from 29 ship building and repair facilities, with the exception of the styrene and MMA emissions[3, 4]. The styrene and MMA emissions from these 29 facilities, along will all other facilities reporting under SIC Code 3731 are a part of the Boat Manufacturing source category. Additional pollutants for these other facilities include:

Acrylonitrile	Chromium	Ethylene Glycol	Manganese
Methyl Chloroform	Methylene Chloride	Nickel	

References

1. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

2. Memorandum from ERG to Ms. Anne Pope, "May 26, 1998 Meeting Summary - Coatings and Consumer Products Group," June 10, 1998.

3. U.S. Environmental Protection Agency. A Guidebook on How to Comply with Shipbuilding and Ship Repair (Surface Coating) Operations National Emission Standards for Hazardous Air Pollutants. EPA 453/B-97-001. January 1997.

4. Telephone conversation between Dr. Mohamed Serageldin, EPA, and Regi Oommen, ERG, Inc. July 22, 1998.

Methodology:

Approach:
1990 estimate of emissions from manufacturing of cadmium compounds are from the document "Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds", July 1995. This document includes emissions estimates for the following: cadmium refining & cadmium oxide production, cadmium stabilizers production, use of cadmium stabilizers for plastics, other cadmium compound production, and cadmium electroplating. Individual tables in the L & E identify, by process, each company and location reporting cadmium emissions in the 1990 Toxic Chemicals Release Inventory (TRI). Spatial allocation of these estimates was based on the location of the facilities identified on Table 4-3 in the L & E.

References:
U.S. Environmental Protection Agency. Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds. Sections 4 and 5. From the: Air CHIEF CD-ROM, Version 4.0. EPA-454/C-95-001. Research Triangle Park, North Carolina. July 1995.

Methodology:

Facility Name	Facility Location	Cadmium Emissions (lb/yr)	Cadmium Emissions (ton/yr)	State FIP Code	County FIP Code
Asarco Inc Globe Plant	Denver, CO	396	0.198	08	031
Big River Zinc Corp	Sauget, IL	1896	0.948	17	163
Jersey Miniere Zinc	Clarksville, TN	500	0.25	47	125
Zinc Corp of America	Bartlesville, OK	6472	3.236	40	113

1990 Annual Emission Estimate = 4.632 tons cadmium compounds from cadmium refining & cadmium oxide production

Methodology:

Approach:
1990 estimate of emissions from manufacturing of cadmium compounds are from the document "Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds", July 1995. This document includes emissions estimates for the following: cadmium refining & cadmium oxide production, cadmium stabilizers production, use of cadmium stabilizers for plastics, other cadmium compound production, and cadmium electroplating. Individual tables in the L & E identify, by process, each company and location reporting cadmium emissions in the 1990 Toxic Chemicals Release Inventory (TRI). Spatial allocation of the estimates was based on the location of the facilities identified on Table 5-4 in the L & E.

References:
U.S. Environmental Protection Agency. Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds. Sections 4 and 5. From the: Air CHIEF CD-ROM, Version 4.0. EPA-454/C-95-001. Research Triangle Park, North Carolina. July 1995.

APPENDIX A: NATIONAL ESTIMATES - Cadmium Stabilizers for Plastics

Methodology:

Facility Name	Facility Location	Cadmium Emissions (lb/yr)	Cadmium Emissions (ton/yr)	State FIP Code	County FIP Code
Rohm & Haas	Bristol, PA	5	0.0025	42	017
Gencorp Polymer Products	New comerstow n, OH	10	0.005	39	157
General Electric Plastics	Selkirk, NY	16	0.008	36	001
Synthetic Products Co*	Stratford, CT	261	0.1305	09	001
Synthetic Products Co	Cleveland, OH	500	0.25	39	035
Monsanto Company	Addyston, OH	11	0.0055	39	061
General Electric Chemicals	Washington, WV	2	0.001	54	107
Huls America, Inc	Mountain Top, PA	250	0.125	42	079
Franklin Burlington Plastics	Burlington, NJ	500	0.25	34	005
O'Sullivan Corp	Lebanon, PA	10	0.005	42	075
O'Sullivan Corp	Winchester, VA	10	0.005	51	840
O'Sullivan Corp	Yerington, NV	10	0.005	32	019
Gary Corp	Leominster, MA	94	0.047	25	027
North America Plastics	Prairie, MS	10	0.005	28	095
Vytron Corp	Loudon, TN	250	0.125	47	105
Standard Products Co	Winnsboro, SC	5	0.0025	45	039
RJF International Corp	Marietta, OH	10	0.005	39	167
Achilles USA, Inc	Everett, WA	35	0.0175	53	061
IPC Corinth Division, Inc	Corinth, MS	250	0.125	28	003
B.F. Goodrich	Pedricktow n, NJ	52	0.026	34	033
Regalite Plastics Corp	New ton Upper Falls, MA	10	0.005	25	017

1990 Annual Emission Estimate 1.1505 tons cadmium compounds from use of cadmium stabilizers for plastics.

* = Synthetic Products Company has tw o plants in Stratford, CT

Methodology:

Approach:
1990 estimate of emissions from manufacturing of cadmium compounds are from the document "Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds", July 1995. This document includes emissions estimates for the following: cadmium refining & cadmium oxide production, cadmium stabilizers production, use of cadmium stabilizers for plastics, other cadmium compound production, and cadmium electroplating. Individual tables in the L & E identify, by process, each company and location reporting cadmium emissions in the 1990 Toxic Chemicals Release Inventory (TRI). Spatial allocation of the estimates was based on the location of the facilities identified on Table 4-9 in the L & E.

References:
U.S. Environmental Protection Agency. Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds. Sections 4 and 5. From the: Air CHIEF CD-ROM, Version 4.0. EPA-454/C-95-001. Research Triangle Park, North Carolina. July 1995.

APPENDIX A: NATIONAL ESTIMATES - Cadmium Stabilizers Production

Methodology:

Facility Name	Facility Location	Cadmium Emissions (lb/yr)	Cadmium Emissions (ton/yr)	State FIP Code	County FIP Code
Akzo Chemical Inc	New Brunswick, NJ	500	0.25	34	023
Witco Corp., Argus Div	Brooklyn, NY	5560	2.78	36	047
Ferro Corp	Bedford, OH	500	0.25	39	035
Rohm & Haas Delaware	Bristol, PA	5	0.0025	42	017
Synthetic Products Co	Stratford, CT	251	0.1255	09	001
Synthetic Products Co	Cleveland, OH	500	0.25	39	035
Vanderbilt Chemical Corp	Bethel, CT	31	0.0155	09	001

1990 Annual Emission Estimate = 3.6735 tons cadmium compounds from cadmium stabilizers production

Methodology:

16-PAH

There is 1 facility (U.S. EPA, 1997).

The estimate comes from the 112(c)(6) report (U.S. EPA, 1997).

Control device information was unavailable.

References

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

The baseline estimates for mercury, 16-PAH and 7-PAH came from the 112(c)(6) report. The method for calculating cadmium compounds is presented on the following page based on the Cadmium Locating and Estimating Document.

REFERENCES

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Cadmium and Cadmium Compounds. Final Report. Research Triangle Park, North Carolina. September 1996.

Methodology:

TABLE 8-5. CARBON BLACK PRODUCTION FACILITIES {Cadmium L&E}							
			Type of			**Capacityb**	
Location			**processa**			**(106 lb)**	
Frabklin, LA			F			310	
Pampa, TX			F			70	
Villa Platte, LA			F			280	
Waverly, WV			F			180	
Cedar Bayou, TX			A			20	
Aranas Pass, TX			F			125	
Belpre, OH			F			130	
New Iberia, LA			F			200	
Melvindale, MI			C			8	
Los Angeles, CA			C			1	
Hiw assee, VA			C			1	
Baytow n, TX			F			225	
Borger, TX			F and T			175	
Orange, TX			F			135	
El Dorado, AR			F			110	
Moundsville, WV			F			170	
North Bend, LA			F			240	
Ulysses, KS			F			80	
Addis, LA			F			145	
Big Spring, TX			F			115	
Borger, TX			F			215	
Phenix City, AL			F			60	
Ponca City, OK			F			145	
Sunray, TX			F			100	
					TOTAL	**3240**	
aA = acetylene decomposition				**Non Furnace Total**		**30**	
C = combustion							
F = furnace			**Non Furnace Percent of Total**			**0.93**	
T = Thermal							
Emission factor (oil furnace process only)							
1.00E-04	lb/ton						
Emission Estimate (oil furnace process only)							
(1) Calculate production: total for all minus production total for non oil furnaces							
=3240-30=	**3210**	million pounds Carbon Black Produced					
(2) Convert production: 3210 million pound to tons per year							
3210000000	lbs X (1Ton/2000lbs)						
1605000	tons/year						
(3) Calculate Emission Rate: Multiply production x emission factor							
	=1.61E+06 x 1.00E-04 lb/ton produced						
160.5	Cadmium Emission Rate (lb/year)						
		Convert to tons/year = 160.5/2000					
8.03E-02	Cadmium Emission Rate (tons/year)						

Methodology:

Emission estimates for 2,3,7,8 TCDD as TEQ were taken from the 112(c)(6) report.

REFERENCES

(112(c)(6) Report)
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Approach:

National emissions were estimated by multiplying emission factors for ABS resin production by total national ABS resin production. The emission factors were obtained from the FIRE database.[1] Total national ABS resin production was available for 1991.[2] It was assumed 1991 production did not differ significantly from 1990 production.

Emissions were spatially allocated based on the known locations and capacities of facilities producing ABS resin.[3] All facilities were assumed to operate at the same percent of capacity. Total national emissions were apportioned to each facility by the ratio of a facility's individual production capacity to the total national capacity.

Data Qualifiers:

(1) Emission factors were available only for certain emission points, so this estimate may not include the entire amount of emissions from this source category.
(2) For the most part, emission factors were available only for uncontrolled operation, so this national estimate is largely for uncontrolled emissions. For one emission point, both controlled and uncontrolled emission factors were available; the average of the two was used. The control status overall or for individual facilities is not known, although the source category may be regulated at the state and federal levels.
(3) Because facility-specific data are not available, the emissions allocated to specific counties may be an under- or over-estimate of actual emissions.

References:

1. U.S. Environmental Protection Agency. *Factor Information Retrieval (FIRE) System Database, Version 5.1a*. Research Triangle Park, North Carolina. September 1995.

2. McCaleb, K.E., ed. *Chemical Origins and Markets, Sixth Edition.* Chemical Marketing Research Center, SRI International. Menlo Park, CA. 1993. p. 85.

3. SRI International. *1990 Directory of Chemical Producers.* Menlo Park, CA. 1990. p. 890.

Methodology:

EMISSION FACTORS FOR ABS RESIN PRODUCTION

	Emission Factors lb styrene/1000 lb resin
Vacuum pump (to extruder) vent	
Uncontrolled	1.39
Controlled (w et scrubber, carbon ads.)	0.006
AVERAGE	0.70
Die vent	0.013
TOTAL	0.71

ACTIVITY DATA FOR ABS RESIN PRODUCTION

	1991 Production (thousands) metric tons	tons
ABS Resins	478	526

TOTAL NATIONAL EMISSIONS OF STYRENE FROM ABS RESIN PRODUCTION

= Total EF * Total resin produced

= (0.71 lb styrene/1000 lb resin) * 526,000 tons resin * 2000 lb/ton

= 746,920 lb styrene

= 373 tons styrene from ABS resin production

EMISSIONS ALLOCATION TO FACILITIES

Company	Location		Capacity MM lb	Emissions tons	State FIP Code	County FIP Code
Diamond Polymers	Akron, OH		22	4.72	39	153
Dow Chemical	Gales Ferry, CT		60	12.9	09	11
	Ironton, OH		80	17.2	39	87
	Midland, MI		150	32.2	26	111
	Torrance, CA		40	8.58	06	37
GE Plastics	Bay St. Louis, MS		210	45.0	29	510
	Ottaw a, IL		300	64.3	17	99
	Oxnard, CA		na	na	06	111
	Washington, WV		350	75.0	54	107
Monsanto Chemical	Addyston, OH		320	68.6	39	61
	Muscatine, IA		210	45.0	19	139
Total	11	facilities	1742	373		

Example Calculation:

Emissions from Diamond Polymers facility

= (Diamond Polymers facility capacity/Total industry capacity) * Total National Styrene Emissions

= (22 MM lb/yr / 1742 MM lb/yr) * 373 tons styrene

= 4.72 tons styrene emitted from Diamond Polymers facility in 1990

Methodology:

ESTIMATE OF EMISSIONS FROM CHEMICAL MANUFACTURING OF CHLOROFORM USING EMISSION FACTORS FROM FIRE

Approach: Emission factors from the Factor Information Retrieval (FIRE) System Database were multiplied by an estimate of the annual chemical production at each facility reported in the "1990 Directory of Chemicals Producers" to produce chloroform. The 1990 chemical production for each facility was estimated by first dividing the total annual production by total annual capacity for 1990, as reported in " Chemical Products Synopsis - Chloroform", September 1992. This factor was then multiplied by the capacity of each facility identified in the "1990 Directory of Chemical Producers." The facility estimates were summed to produce the 1990 national estimate of emissions of chloroform from chemical manufacturing of chloroform. Spatial allocation of the estimates for each source category was based on the location of each facility identified in the "1990 Directory of Chemical Producers".

Data Qualifiers:

Two different factors applicable to chemical manufacturing of chloroform are in FIRE. The factors, for industrial process and waste disposal emissions, (0.70 and 0.42 lb/ton) were added together to estimate emissions from this source category. Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emissions from this source category.

Example Calculations:

Annual Production: 483 (million lbs chloroform produced, 1990) / 545 (million lbs capacity to produce chloroform, 1990) = 0.8862

0.8862 x 120 (million lbs capacity to produce chloroform in 1990) = 106 million lbs chloroform produced at one facility.

Emissions Estimate:

106 (million lbs chloroform produced) x (1 ton / 2000 lbs) x 1.12 lbs chloroform / ton produced =

= 5.936E4 lbs chloroform from chemical manufacturing of chloroform x (1 ton / 2000 lbs) =

= 29.68 tons chloroform from chemical manufacturing of chloroform

<u>References:</u>

U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Mannsville Chemical Products Corporation. Chemical Products Synopsis - Chloroform. September 1992.

1990 Directory of Chemical Producers. SRI International. Menlo Park, CA. 1990. p 531.

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Emission Factor	Chloroform Emissions (tons/year)	State FIP Code	County FIP Code
Dow Chemical	Freeport, TX	120	106	1.12	29.78	48	039
Dow Chemical	Plaquemine, LA	120	106	1.12	29.78	22	047
Hanlin Group, LCP Chemicals Division	Moundsville, WV	40	35	1.12	9.93	54	051
Occidental Chemical Corp	Belle, WV	30	27	1.12	7.44	54	039
Vulcan Chemicals	Geismar, LA	60	53	1.12	14.89	22	005
Vulcan Chemicals	Wichita, KS	110	97	1.12	27.29	20	173
1990 Annual Emission Estimate =	119.10528	tons chloroform/year from chemical manufacturing chloroform					

Emission factor units = lb/ton chloroform produced

Methodology:

ESTIMATE OF EMISSIONS FROM CHEMICAL MANUFACTURING OF CHLOROFORM USING EMISSION FACTORS FROM FIRE

Approach: Emission factors from the Factor Information Retrieval (FIRE) System Database were multiplied by an estimate of the annual chemical production at each facility reported in the "1990 Directory of Chemicals Producers" to produce chloroform. The 1990 chemical production for each facility was estimated by first dividing the total annual production by total annual capacity for 1990, as reported in " Chemical Products Synopsis - Chloroform", September 1992. This factor was then multiplied by the capacity of each facility identified in the "1990 Directory of Chemical Producers." The facility estimates were summed to produce the 1990 national estimate of emissions of chloroform from chemical manufacturing of chloroform. Spatial allocation of the estimates for each source category was based on the location of each facility identified in the "1990 Directory of Chemical Producers".

Data Qualifiers:

Three different factors applicable to chemical manufacturing of chloroform are in FIRE. Two factors apply to industrial process and waste disposal emissions. The third factor, (3.31 lb/ton) is used here to estimate emissions from storage of chloroform. Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emissions from this source category.

Example Calculations:

Annual Production: 483 (million lbs chloroform produced, 1990) / 545 (million lbs capacity to produce chloroform, 1990) = 0.8862

0.8862 x 120 (million lbs capacity to produce chloroform in 1990) = 106 million lbs chloroform produced at one facility.

Emissions Estimate:

106 (million lbs chloroform produced) x (1 ton / 2000 lbs) x 3.31 lbs chloroform / ton produced =

= 175430 lbs chloroform from storage of chloroform x (1 ton / 2000 lbs) =

= 87.715 tons chloroform from storage of chloroform at chloroform production facilities.

References:

U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Mannsville Chemical Products Corporation. Chemical Products Synopsis - Chloroform. September 1992.

1990 Directory of Chemical Producers. SRI International. Menlo Park, CA. 1990. p 531.

APPENDIX A: NATIONAL ESTIMATES - Chemical Manufacturing: Chloroform Production (Storage Emissions)

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Emission Factor	Chloroform Emissions (tons/year)	State FIP Code	County FIP Code
Dow Chemical	Freeport, TX	120	106	3.31	88.00	48	039
Dow Chemical	Plaquemine, LA	120	106	3.31	88.00	22	047
Hanlin Group, LCP Chemicals Division	Moundsville, WV	40	35	3.31	29.33	54	051
Occidental Chemical Corp	Belle, WV	30	27	3.31	22.00	54	039
Vulcan Chemicals	Geismar, LA	60	53	3.31	44.00	22	005
Vulcan Chemicals	Wichita, KS	110	97	3.31	80.67	20	173
1990 Annual Emission Estimate =	351.99864	tons chloroform/year from storage of chloroform					

Emission factor units = lb/ton chloroform produced

Methodology:

Appropriate emission factors from the Factor Information Retrieval (FIRE) System Database[1] were multiplied by an estimate of the annual chemical production at each facility reported in the *1990 Directory of Chemicals Producers*[2] to produce methyl chloride, also called chloromethane. The *Chemical Products Synopsis - Methyl Chloride*,[3] states that methyl chloride is an intermediate of the three other chloromethanes (methylene chloride, chloroform, and carbon tetrachloride), so the manufacture of methyl chloride is an appropriate surrogate to estimate emissions from manufacture of chloromethanes in general. Emission factors were available for methyl chloride and chloroform from methyl chloride production.[1] Tables 1 and 2 (attached) contain the calculations for both emissions estimates.

The 1990 chemical production was estimated by dividing the total annual production of methyl chloride by total annual capacity to produce methyl chloride for 1990, as reported in *Chemical Products Synopsis - Methyl Chloride*.[3] This factor was then multiplied by the capacity of each facility identified in the *1990 Directory of Chemical Producers*[2] to estimate the methyl chloride production at each facility. The facility estimates were then summed to produce the 1990 national estimate of emissions from chemical manufacturing of methyl chloride. Spatial allocation of the estimates for each source category was based on the location of each facility identified in the *1990 Directory of Chemical Producers*.[2] Note that the sum of the capacities for each facility from Reference 3 does not match the total capacity reported in Reference 2.

Chloroform Emissions
Three different chloroform emission factors (0.016, 0.0066, 0.427 lb/ton methyl chloride produced) were in FIRE.[1] These factors, described as general, recycled methane inert-purge, and fugitive, were added together to estimate chloroform emissions to give 0.4496 lbs chloroform/ton methyl chloride produced.

Example Calculations for Chloroform Emissions Estimate:
Ratio of 1990 annual production to annual capacity: 772 million lb methyl chloride produced, 1990 /780 million lb capacity to produce methyl chloride, 1990 = 0.9897

Annual production at one facility in 1990:
0.9897 x 50 million lb capacity to produce methyl chloride in 1990 = 49.49 million lb methyl chloride at one facility.

Estimate for chloroform emissions at one facility:
49.49 million lb methyl chloride produced x 1 ton/2000 lb x 0.4496 lb chloroform/ton methyl chloride produced = 11,125 lbs chloroform

11,1125 lb chloroform x 1 ton/2000 lbs = 5.56 ton chloroform from chemical manufacturing of methyl chloride at one facility

Methyl Chloride Emissions
Methyl chloride emission factors in FIRE[1] were based on data from only one plant, or from a hypothetical facility. Two different factors were in FIRE[1] for the similar described process categories of recycled methane inert-purge, and inert gas purge vent for condenser (3.0 and 4.08 lb/ton of methyl chloride produced, respectively). The average of the two factors, 3.54 lb/ton of methyl chloride produced, was used to estimate the emissions for this category.

The methodology used to calculate chloroform emissions was used to calculate methyl chloride emissions.

References:

1. U.S. Environmental Protection Agency. 1995 (September). Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park , NC.

2. SRI International. 1990. *1990 Directory of Chemical Producers*. Menlo Park, CA.

3. Mannsville Chemical Products Corporation. 1993 (October). *Chemical Products Synopsis - Methyl Chloride.*

Methodology:

Table 1: Chloroform Emissions from Methyl Chloride Production

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Emission Factor*	Chloroform Emissions (tons/yr)	State FIP Code	County FIP Code
Dow Chemical	Freeport, TX	50.00	49.49	0.4496	5.56	48	39
Dow Chemical	Plaquemine, LA	150.00	148.46	0.4496	16.69	22	47
Dow Corning Corp	Carrollton, KY	200.00	197.94	0.4496	22.25	21	41
Dow Corning Corp	Midland, MI	50.00	49.49	0.4496	5.56	26	111
General Electric Co, GE Plastics	Waterford, NY	105.00	103.92	0.4496	11.68	36	91
Hanlin Group Inc, LCP Chemicals Div	Moundsville, WV	25.00	24.74	0.4496	2.78	54	51
Vulcan Materials Co, Vulcan Chemicals	Lake Charles, LA	115.00	113.82	0.4496	12.79	22	19
1990 Annual Chloroform Emission Estimate =		**77.31**	**tons chloroform/year from methyl chloride produced**				

*Emission factor units = lb chloroform/ ton methyl chloride produced

Table 2: Methyl Chloride Emissions from Methyl Chloride Production

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Emission Factor*	Methyl Chloride Emissions (tons/yr)	State FIP Code	County FIP Code
Dow Chemical	Freeport, TX	50.00	49.49	3.54	43.79	48	039
Dow Chemical	Plaquemine, LA	150.00	148.46	3.54	131.38	22	047
Dow Corning Corp	Carrollton, KY	200.00	197.94	3.54	175.18	21	041
Dow Corning Corp	Midland, MI	50.00	49.49	3.54	43.79	26	111
General Electric Co, GE Plastics	Waterford, NY	105.00	103.92	3.54	91.97	36	091
Hanlin Group Inc, LCP Chemicals Div	Moundsville, WV	25.00	24.74	3.54	21.90	54	051
Vulcan Materials Co, Vulcan Chemicals	Lake Charles, LA	115.00	113.82	3.54	100.73	22	019
1990 Annual Methyl Chloride Emission Estimate =		**608.74**	**tons methyl chloride/year from methyl chloride produced**				

*Emission factor units = lb methyl chloride / ton methyl chloride produced

Methodology:

Approach:
A 1992 estimate of emissions of chromium compounds from manufacturing of chromium compounds was provided by U.S. EPA/ESD. Production data necessary to estimate 1990 emissions were not available so the 1992 estimates were used as documented in the draft report.
There are only two U.S. facilities producing chromium chemicals. The locations of both facilities are known, and they are both area sources.

References:
U.S. Environmental Protection Agency, Emission Standards Division. Chromium Chemicals Manufacturing Summary Report. Draft. Research Triangle Park, North Carolina. February 16, 1994. Information provided by I. Rosario, EPA:ESD, to D. Pickett, Eastern Research Group, Inc. July 24, 1997.

Methodology:

Facility Name	Facility Location	Chromium Compounds Emissions (ton/year)	State FIP Code	County FIP Code
Occidental Chemical Corp	Castle Hayne, NC	4.59	37	129
American Chrome and Chemical	Corpus Christi, TX	5.20	48	355
1990 annual emission estimate =	9.79	tons chromium compound emissions from manuf. chromium chemicals		

Methodology:

Approach: Appropriate emission factors from the Factor Information Retrieval (FIRE) System Database were multiplied by an estimate of annual chemical production at each facility reported in the 1990 Directory of Chemicals Producers to produce1,1,1-trichloroethane (also called methyl chloroform or TCEA). The 1990 production of TCEA was estimated at each facility by first dividing the total annual production by total annual capacity for 1990, as reported in "Chemical Products Synopsis - 1,1,1-Trichloroethane", November, 1992. This factor was then multiplied by the capacity of each facility identified in the "1990 Directory of Chemical Producers" to estimate the production at each facility.

The facility estimates for each chemical were summed to produce the 1990 national estimate of emissions from chemical manufacturing of 1,1,1-trichloroethane. Spatial allocation of the estimates for each chemical was based on the location of each facility identified in the "1990 Directory of Chemical Producers".

Data Qualifiers:

1,2-Dichloroethane (EDC) emission factors in FIRE are applicable to uncontrolled and controlled emissions from the production of TCEA from ethane (0.138 and 0.00200 lb/ton) and from vinyl chloride (0.360 and 0.00800 lb/ton). The average of the uncontrolled and controlled emission factors was used to estimate emissions. The "Chemical Products Synopsis - 1,1,1-Trichloroethane" reports the dominate process involves the hydrochlorination of vinyl chloride (VC). The " Chemical Product Synopsis - Ethylene Dichloride" identifies Vulcan Chemical as the only producer of TCEA that does not also manufacture vinyl chloride monomer. Based on this information, the factors applicable to production from ethane were used to estimate emissions from Vulcan Chemicals, and the factors applicable to production from vinyl chloride were used to estimate emissions from the other two facilities.

Additional emission factors for hydrochlorinator vent (3.40 lb/ton) and hydrochlorinator vent condenser and steam stripper vent condenser (9.00 lb/ton) are also in FIRE. Due to the possibility of double counting emissions from the production of TCEA from VC, and the magnitude and age of these factors, they were not used to estimate emissions. Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emissions from this source category.

Example Calculations:

Percent of annual production capacity for TCEA produced:

801 (million lbs TCEA total produced) / 1050 (million lbs total capacity to produce TCEA) = 0.7629

For one facility, 1990 production estimated at:

0.7629 x 500 (million lbs capacity to produce TCEA , 1990) = 381.43 million lbs TCEA produced at one facility

Emissions Estimate (at one facility):

0.360 + 0.008 (lb EDC / ton TCEA produced) / 2 = 0.184 lb EDC / ton TCEA produced

381.45 (million lbs TCEA produced) x (1 ton / 2000 lbs) x 0.184 lbs EDC / ton TCEA produced =

= 35093 lbs EDC from chemical manufacturing of TCEA x (1 ton / 2000 lbs) =

= 17.5467 tons EDC from chemical manufacturing of TCEA at one facility.

Vinyl Chloride Emissions

Vinyl chloride emission factors in FIRE are applicable to distillation column vent emissions. Factors for uncontrolled emissions (0.0140 lb/ton) and controlled by incineration (0.0002 lb/ton) are presented. The factors are based on engineering judgment and are representative of a hypothetical plant with 300,000,000 lb/yr production capacity. The average of the uncontrolled and controlled emission factors was used to estimate emissions. Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emissions from this category.

The methodology used to calculate EDC emissions was used to calculate vinyl chloride emissions.

References:

U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

SRI International 1990 Directory of Chemical Producers. SRI International. Menlo Park, CA. 1990. p 1046.

Mannsville Chemical Products Corporation. Chemical Product Synopsis - 1,1,1-Trichloroethane. November 1992.

Mannsville Chemical Products Corporation. Chemical Product Synopsis - Ethylene Dichloride. February 1991.

APPENDIX A: NATIONAL ESTIMATES - Chemical Manufacturing: Methyl Chloroform

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Average EDC Emission Factor*	EDC Emissions (ton/year)	Average VC Emission Factor**	VC Emissions (ton/year)	State FIP Code	County FIP Code
Dow Chemical	Freeport, TX	500	381.45	0.184	17.55	0.007	0.68	48	039
PPG Chemicals Group	Lake Charles, LA	350	267.02	0.184	12.28	0.014	0.93	22	019
Vulcan Chemicals	Geismar, LA	200	152.58	0.184	7.02	0.014	0.53	22	005
Total 1990 Estimate=					**36.85**		**2.15**		

*Emission factor units = lb EDC / ton TCEA produced

**Emission factor units = lb VC per ton TCEA produced

Methodology:

The estimate was taken directly from the 112(c)(6) report (1997).

Spatial allocation of the estimates was based on the location of each facility reported to produce naphthalene from coal tar in the "1990 Directory of Chemical Producers".

Data Qualifiers:
The 16-PAH emission factor was developed from individual PAH emission factors for the coal tar distillation process. The 16-PAH factor only includes naphthalene.

References:
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM); 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) / 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs); Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997. pp. B-75.

1990 Directory of Chemical Producers. SRI International. Menlo Park, CA. p. 805.

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	16-PAH Emissions (tons/year)	State FIP Code	County FIP Code
Allied-Signal	Ironton, OH	75	21.5	39	087
Koppers Industries	Follansbee, WV	150	43.1	54	009
1990 Annual Emission Estimate =		64.6			

Methodology:

The estimate is taken directly from the 112(c)(6) report (1997).

The locations of naphthalene sulfonates producing facilities are reported in the "1990 Directory of Chemical Producers." However, the capacities are not known, so emissions were allocated to each facility equally.

Data Qualifiers: The 16-PAH emission factor was developed from individual PAH emission factors for naphthalene sulfonate production. The 16-PAH factor only includes naphthalene.

References:

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM); 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) / 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs); Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997. pp. B-78.

1990 Directory of Chemical Producers. SRI International. Menlo Park, CA. p. 805.

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	16-PAH Emissions (tons/year)	State FIP Code	County FIP Code
American Cyanamid Company	Marietta, OH	unknown	1.31	39	159
New Hampshire Oak	Claymont, DE	unknown	1.31	10	001
Henkel Corp, Organic Products	Carlstadt, NJ	unknown	1.31	34	003
Greenwood Chemical Co	Cedartown, GA	unknown	1.31	13	233
Texaco Chemical	Greenwood, VA	unknown	1.31		
1990 Annual Emission Estimate =			6.53		

Methodology:

Approach:
Emission factors from the Factor Information Retrieval (FIRE) System Database were multiplied by an estimate of the annual chemical production reported in the "1990 Directory of Chemicals Producers" to produce 1,4-Dichlorobenzene. The 1990 chemical production at each facility was estimated by first dividing the total annual production by total annual capacity for 1990, as reported in " Chemical Products Synopsis - Dichlorobenzene" , December 1995. This factor was then multiplied by the capacity of each facility identified in the "1990 Directory of Chemical Producers". The facility estimates were summed to produce the 1990 national estimate of emissions of 1,4-dichlorbenzene from chemical manufacturing of 1,4-dichlorobenzene. Spatial allocation of the estimates for each source category was based on the location of each facility identified in the "1990 Directory of Chemical Producers". When this information was not provided, the "1993 Worldwide Petrochemical Directory" was consulted.

Data Qualifiers:
Three factors applicable to chemical manufacturing of 1,4-dichlorobenzene are in FIRE. Two of the factors, applicable to process and fugitive emissions, (11.62 and 2.04) were added together to estimate emissions for this category. The third factor, applicable to organic chemical storage was applied separately to estimate those emissions. All factors are for a hypothetical plant. Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emissions from this source category.

Example Calculations:
Percent of Annual Production Capacity:
90 million lbs p-dichlorobenzene total produced, 1990 / 138 million lbs total capacity to produce p-dichlorobenzene, 1990 = 0.6522

For one facility, 1990 production estimated at:

0.6522 x 25 (million lbs capacity to produce p-dichlorobenzene in 1990)
= 16.30 million lbs of p-dichlorobenzene produced at one facility.

Emissions Estimate (at one facility):
16.3 (million lbs 1,4-dichlorobenzene produced) x (1 ton / 2000 lbs) x 13.66 lbs 1,4-dichlorobenzene / ton produced
= 111,329 lbs 1,4-dichlorobenzene x (1 ton / 2000 lbs)
= 55.6645 tons 1,4-dichlorobenzene from chemical manufacturing of chlorobenzene

References:
U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Mannsville Chemical Products Corporation. Chemical Products Synopsis - Dichlorobenzene. December 1995.

SRI International. 1990 Directory of Chemical Producers. Menlo Park, CA. 1990. p 561.

PennWell Directories. 1993 Worldwide Petrochemical Directory, 31st Edition. Tulsa, OK. August 1992. pp. 40, 48.

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Emission Factor	1,4- Dichloro-Benzene Emissions (tons/year)	State FIP Code	County FIP Code
Monsanto Chemical Co.	Sauget, IL	25	16.305	13.66	55.68	17	163
Organics/Lagrange Inc	Irwindale, CA	2	1.3044	13.66	4.45	06	037
PPG Industries, Chemical Group	Natrium, WV	30	19.566	13.66	66.82	54	103
Standard Chlorine Chemical Co	Delaware City, DE	75	48.915	13.66	167.04	10	003
1990 Annual Emission Estimate =		294.00	tons 1,4-dichlorobenzene/year				

Emission factor units = lb/ton 1,4-Dichlorobenzene produced

Methodology:

ESTIMATE OF EMISSIONS FROM CHEMICAL MANUFACTURING OF 1,4-DICHLOROBENZENE
Approach: Emission factors from the Factor Information Retrieval (FIRE) System Database were multiplied by an estimate of the annual chemical production at each facility reported in the "1990 Directory of Chemicals Producers" to produce 1,4-Dichlorobenzene. The 1990 chemical production at each facility was estimated by dividing the total annual production by total annual capacity for 1990, as reported in " Chemical Products Synopsis - Dichlorobenzene" , December 1995. This factor was then multiplied by the capacity of each facility identified in the "1990 Directory of Chemical Producers". The facility estimates were summed to produce the 1990 national estimate of emissions of 1,4-dichlorbenzene from chemical manufacturing of 1,4-dichlorobenzene. Spatial allocation of the estimates for each source category was based on the location of each facility identified in the "1990 Directory of Chemical Producers". When this information was not provided, the "1993 Worldwide Petrochemical Directory" was consulted.

Data Qualifiers: Three factors applicable to chemical manufacturing of 1,4-dichlorobenzene are in FIRE. Two of the factors, apply to process and fugitive emissions. The third factor, (0.82) is used here to estimate emissions from organic chemical storage. All three factors are for a hypothetical plant.
Example Calculations:
Annual Production:
90 (million lbs p-dichlorobenzene produced, 1990) / 138 (million lbs capacity to produce p-dichlorbenzene, 1990 =
= 0.6522 x 25 (million lbs capacity to produce p-dichlorobenzene in 1990)
= 16.30 million lbs of p-dichlorobenzene produced at one facility.
Emissions Estimate:
16.3 (million lbs 1,4-dichlorobenzene produced) x (1 ton / 2000 lbs) x 13.66 lbs 1,4-dichlorobenzene / ton produced
= 6685 lbs 1,4-dichlorobenzene x (1 ton / 2000 lbs)
= 3.34 tons 1,4-dichlorobenzene from chemical manufacturing of chlorobenzene

References:
U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.
Mannsville Chemical Products Corporation. Chemical Products Synopsis - Dichlorobenzene. December 1995.
1990 Directory of Chemical Producers. SRI International. Menlo Park, CA. 1990. p 561.
1993 Worldwide Petrochemical Directory, 31st Edition. PennWell Directories. Tulsa, OK. August 1992. pp. 40, 48.

APPENDIX A: NATIONAL ESTIMATES - Chemical Manufacturing: p-Dichlorobenzene (Storage Emissions)

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Emission Factor	1,4- Dichloro-Benzene Emissions (tons/year)	State FIP Code	County FIP Code
Monsanto Chemical Co	Sauget, IL	25	16.305	0.82	3.34	17	163
Organics/Lagrange Inc	Irw indale, CA	2	1.3044	0.82	0.27	06	037
PPG Industries, Chemical Group	Natrium, WV	30	19.566	0.82	4.01	54	103
Standard Chlorine Chemical Co.	Delaw are City, DE	75	48.915	0.82	10.03	10	003
1990 Annual Emission Estimate =		17.648532	tons 1,4-dichlorobenzene/year				
Emission factor units = lb/ton 1,4-dichlorobenzene produced							

Methodology:

Approach:
An emission factor from the Factor Information Retrieval (FIRE) System Database was multiplied by an estimate of the annual chemical production at each facility reported in "1990 Directory of Chemical Producers". The 1990 chemical production for each facility was estimated by first dividing the total annual production reported in "Chemical Products Synopsis -Phenol", July 1992, by the total annual capacity, and then multiplying this factor by the capacity for each facility reported in the "Directory of Chemical Producers".

The emission factor is representative of emissions from the cumene oxidation process, so only those facilities that produce phenol by the cumene peroxidation process were included when estimating annual production. The facility estimates were summed to produce the 1990 national estimate of emissions from chemical manufacturing of phenol.

Spatial allocation of the estimates was based on the location of each facility. Facility locations were identified in the "1990 Directory of Chemical Producers." When this information was not provided, the "1993 Worldwide Petrochemical Directory" was consulted.

Example Calculations:
Percent of Annual Production Capacity:
3538 (million lbs phenol total produced in 1990) / 3880 (million lbs total capacity to produce phenol in 1990) = 0.9119

For one facility, 1990 production estimated at:

0.9119 x 800 (million lbs capacity to produce phenol in 1990) = 729.52 million lbs phenol produced at facility.

Emissions Estimate (at one facility):
730 (million lbs phenol produced) x (1 ton / 2000 lbs) x .0042 lbs acetaldehyde / ton phenol produced =
= 1532 lbs acetaldehyde from chemical manufacturing of phenol x (1 ton / 2000 lbs)
= 0.7660 tons acetaldehyde from chemical manufacturing of phenol at one facility.

References:
U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Mannsville Chemical Products Corporation. Chemical Products Synopsis - Phenol. July, 1992.

SRI International. 1990 Directory of Chemical Producers. Menlo Park, CA. 1990. p. 851.

PennWell Directories. 1993 Worldwide Petrochemical Directory, 31st Edition. Tulsa, OK. August 1992. pp. 37.

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Emission Factor	Acetaldehyde Emissions (tons/year)	State FIP Code	County FIP Code
Allied-Signal Inc, Engineered Materials Sector	Philadelphia (Frankford), PA	800	730	0.0042	0.77	42	101
Aristech Chemical Corp	Haverhill, OH	630	574	0.0042	0.60	39	145
BTL Specialty Resins Corp	Blue Island, IL	85	78	0.0042	0.08	17	031
Dow Chemical USA	Oyster Creek, TX	550	502	0.0042	0.53	48	039
Georgia Gulf Corp	Bound Brook, NJ	157 (a)					
Georgia Gulf Corp	Plaquemine, LA	420	383	0.0042	0.40	22	047
General Electric Co	Mount Vernon, IN	640	584	0.0042	0.61	18	129
Shell Oil Co, Shell Chemical Div	Deer Park, TX	600	547	0.0042	0.57	48	201
Texaco, Inc, Texaco Chemical Co.	El Dorado, KS	95	87	0.0042	0.09	20	015
1990 Annual Emission Estimate =		3.66E+00	tons acetaldehyde/year				
Emission factor units = lb/ton phenol produced							

Methodology:

ESTIMATE OF EMISSIONS OF STYRENE FROM CHEMICAL MANUFACTURING

Approach: Emission factors from the Factor Information Retrieval (FIRE) System Database were multiplied by an estimate of the annual chemical production at each facility reported to produce styrene. Production facilities were identified in "Locating and Estimating Air Emissions from Sources of Styrene", April 1993. The 1990 production of styrene at each facility was estimated by first dividing the total annual production by the total annual capacity for 1990, as reported in "Chemical Product Synopsis - Styrene", March 1992. This factor was then multiplied by the capacity of each facility identified in the L & E document. The facility estimates were summed to produce the 1990 national estimate of emissions of styrene from chemical manufacturing of styrene. Spatial allocation of the estimates for each source category was based on the location of each facility identified in the L & E document.

Data Qualifiers: Emission factors (EF) in FIRE are representative of emissions from benzene/toluene vacuum column (0.0730 lb / ton), and from nonbenzene/toluene vacuum column (0.0328 lb / ton). These factors were added together to estimate styrene emissions. Factors are assumed uncontrolled. Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emissions from this source category.

Two emission factors in FIRE (0.170000 and 1.50000 lb/gal) were representative of uncontrolled breathing and working losses from organic chemical storage. The factors were applied separately to estimate emissions from these sources. The estimates were then added together and reported as one.

Emission factors are in units of lb/1000 gallon material throughput (working loss) and lb/1000 gallon storage capacity (breathing loss). Because facility storage capacity was not known, it was assumed the capacity and material throughput would both be equal to the estimated facility production.

Example Calculations:
Percent of Annual Production Capacity:

8017 (million lbs styrene produced, 1990) / 9540 (million lbs capacity to produce styrene, 1990) = 0.84036

For one facility, 1990 production estimated at:

0.84036 x 800 (million lbs capacity to produce styrene in 1990) = 672.29 million lbs styrene produced at a facility

Emission Factor: (0.0730 lb / ton + 0.0328 lb / ton) = 0.1058 lb styrene / ton styrene produced

Emissions Estimate (at one facility):

672.29 (million lbs styrene produced) x (1 ton / 2000 lbs) x 0.1058 lb styrene / lb styrene produced=
= 35564 lbs styrene x (1 ton / 2000 lbs) =
= 17.78 tons styrene from chemical manufacturing of styrene at one facility

References:

U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Mannsville Chemical Products Corporation. Chemical Products Synopsis - Styrene. March 1992.

U.S. Environmental Protection Agency. Locating And Estimating Air Emissions from Sources of Styrene. April 20, 1993. EPA-454/R-93-011.

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Styrene Emission Factor	Styrene Emissions (tons/year)	State FIP Code	County FIP Code
Amoco Corp	Texas City, TX	800	672	0.1058	1.78E+01	48	167
ARCO Chemical Co	Channelview , TX	1310	1101	0.1058	2.91E+01	48	201
ARCO Chemical Co	Monaca, PA	220	185	0.1058	4.89E+00	42	007
Chevron Corp	St. James, LA	600	504	0.1058	1.33E+01	22	093
Cos-Mar	Carville, LA	1500	1261	0.1058	3.33E+01	22	047
Dow Chemical	Freeport, TX	1410	1185	0.1058	3.13E+01	48	039
Hoechst Celanese (Huntsman Chemical)	Bayport, TX	1000	840	0.1058	2.22E+01	48	201
Rexene Products Co	Odessa, TX	320	269	0.1058	7.11E+00	48	135
Sterling Chemicals	Texas City, TX	1500	1261	0.1058	3.33E+01	48	167
	1990 Annual Emission Estimate =			1.92E+02	tons styrene / year		

Emission Factor Units = lb styrene / ton styrene produced

Methodology:

ESTIMATE OF EMISSIONS FROM CHEMICAL MANUFACTURING OF STYRENE USING EMISSION FACTORS FROM FIRE

Approach: Emission factors from the Factor Information Retrieval (FIRE) System Database were multiplied by an estimate of the annual chemical production at each facility reported to produce styrene. Production facilities were identified in "Locating and Estimating Air Emissions from Sources of Styrene", April 1993. The 1990 production of styrene at each facility was estimated by first dividing the total annual production by the total annual capacity for 1990, as reported in "Chemical Product Synopsis - Styrene", March 1992. This factor was then multiplied by the capacity of each facility identified in the L & E document. The facility estimates were summed to produce the 1990 national estimate of emissions of styrene from chemical manufacturing of styrene. Spatial allocation of the estimates for each source category was based on the location of each facility identified in the L & E document.

Data Qualifiers: Emission factors (EF) in FIRE are representative of emissions from benzene/toluene vacuum column (0.0730 lb / ton), and from nonbenzene/toluene vacuum column (0.0328 lb / ton). These factors were added together to estimate styrene emissions. Factors are assumed uncontrolled. Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emissions from this source category.

Two emission factors in FIRE (0.170000 and 1.50000 lb/gal) were representative of uncontrolled breathing and working losses from organic chemical storage. The factors were applied separately to estimate emissions from these sources. The estimates were then added together and reported as one. Emission factors are in units of lb/1000 gallon material throughput (working loss) and lb/1000 gallon storage capacity (breathing loss). Since facility storage capacity was not known, it was assumed the capacity and material throughput would both be equal to the estimated facility production.

Example Calculations:
Annual Production:
8017 (million lbs styrene produced, 1990) / 9540 (million lbs capacity to produce styrene, 1990) = 0.84036
0.84036 x 800 (million lbs capacity to produce styrene in 1990) = 672.29 million lbs styrene produced at a facility
Emissions Estimate:
672 (million lbs styrene produced) x (1 ton / 2000 lbs) x 0.1058 lb styrene / lb styrene produced=
= 35549 lbs styrene x (1 ton / 2000 lbs) =
= 17.77 tons styrene from chemical manufacturing of styrene at one facility
672 (million lbs styrene produced (stored)) x (0.1198 lbs H2O / gal H2O) x 0.909 density styrene =
= 73.17959 million gallons styrene produced (stored)
73.17959 million gallons styrene x (1.5 lbs styrene / 1000 gallon storage capacity) =
= 109769 lbs styrene breathing losses from organic chemical storage x (1 ton / 2000 lbs) =
= 54.88 tons styrene breathing losses from organic chemical storage of styrene

References:

U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Mannsville Chemical Products Corporation. Chemical Products Synopsis - Styrene. March 1992.

U.S. Environmental Protection Agency. Locating And Estimating Air Emissions from Sources of Styrene. April 20, 1993. EPA-454/R-93-011.

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Breathing Loss EF (a)	Breathing Loss Emissions (tons/year)	Working Loss EF (b)	Working Loss Emissions (tons/year)	Styrene Storage Emissions (tons/year)	State FIP Code	County FIP Code
Amoco Corp	Texas City, TX	800	672	1.5	5.49E+01	0.17	6.22E+00	6.11E+01	48	167
ARCO Chemical Co	Channelview , TX	1310	1101	1.5	8.99E+01	0.17	1.02E+01	1.00E+02	48	201
ARCO Chemical Co	Monaca, PA	220	185	1.5	1.51E+01	0.17	1.71E+00	1.68E+01	42	007
Chevron Corp	St. James, LA	600	504	1.5	4.12E+01	0.17	4.67E+00	4.58E+01	22	093
Cos-Mar	Carville, LA	1500	1261	1.5	1.03E+02	0.17	1.17E+01	1.15E+02	22	047
Dow Chemical	Freeport, TX	1410	1185	1.5	9.68E+01	0.17	1.10E+01	1.08E+02	48	039
Hoechst Celanese (Huntsman Chemical)	Bayport, TX	1000	840	1.5	6.86E+01	0.17	7.78E+00	7.64E+01	48	201
Rexene Products Co	Odessa, TX	320	269	1.5	2.20E+01	0.17	2.49E+00	2.45E+01	48	135
Sterling Chemicals	Texas City, TX	1500	1261	1.5	1.03E+02	0.17	1.17E+01	1.15E+02	48	167
	1990 Annual Emission Estimate =				6.62E+02	tons styrene/year from organic chemical storage				

(a) Breathing Loss Emission Factor Units = lb/1000 gal storage capacity

(b) Working Loss Emission Factor Units = lb/1000 gal material throughput

Methodology:

Approach:

National emissions were estimated by multiplying emission factors for styrene-butadiene (S-B) and styrene-butadiene rubber (SBR) latexes production by total national S-B and SBR latexes production. The emission factors were obtained from the Styrene L&E (EPA, 1993) and the FIRE database (EPA, 1995). Total national S-B and SBR latexes production was available for 1991 (McCaleb, 1993). It was assumed 1991 production did not differ significantly from 1990 production.

Emission factors were available only for SBR-emulsion/solution production. However, the emission factors can be used for S-B latex as well because the processes for making S-B and SBR latexes are identical. It is assumed that the emission factors reflect the lower styrene content of SBR latexes, which average 25% styrene (Lewis, 1993). To account for the higher styrene content in S-B latex (and hence increased use and emissions of styrene monomer), it was assumed that S-B latexes average at least 50% styrene content. The emission factors were increased by the ratio of 50% to 25%, or 2, when used to estimate S-B latex emissions.

Emissions could be spatially allocated because the locations and capacities of facilities producing S-B and SBR latexes are known (McCaleb, 1990). All facilities were assumed to operate at the same percent of capacity, and total national emissions were apportioned to each facility by the ratio of a facility's individual production capacity to the total national capacity.

Data Qualifiers:

(1) Emission factors were available only for certain emission points, so this estimate may not include the entire amount of emissions from this source category.
(2) Emission factors were available only for uncontrolled operation, so this national estimate is for uncontrolled emissions. The control status overall or for indiviudal facilities is not known, although the source category may be regulated at the state and federal levels.

References:

U.S. Environmental Protection Agency. *Locating and Estimating Air Emissions from Sources of Styrene.* Research Triangle Park, North Carolina. April 1993. pp. 53-65.

U.S. Environmental Protection Agency. *Factor Information Retrieval (FIRE) System Database, Version 5.1a.* Research Triangle Park, North Carolina. September 1995.

McCaleb, K.E., ed. *Chemical Origins and Markets, Sixth Edition.* Chemical Marketing Research Center, SRI International. Menlo Park, CA. 1993. p. 86 & 88.

Lewis, R..J., rev. *Hawley's Condensed Chemical Dictionary, 12th Edition*. Van Nostrand Reinhold Co. New York, NY. 1993. p. 1097.

SRI International. *1990 Directory of Chemical Producers*. Menlo Park, CA. 1990. p. 913.

Methodology:

EMISSION FACTORS FOR S-B AND SBR LATEX PRODUCTION

Emission Factors	lb styrene/ton resin	Reference
Styrene Monomer Storage:		
Fugitive Emissions	0.8	L&E
Breathing Emissions	0.04	L&E
Polymer Blend Tanks	0.2	FIRE
Monomer Removal	0.3	FIRE
TOTAL	1.34	

ACTIVITY DATA FOR S-B AND SBR LATEX PRODUCTION

	1991 Production (thousands)	
	metric tons	tons
Styrene-Butadiene Latex (SB Copolymer)	473	520
SBR Latex	43	47
TOTAL		568

TOTAL NATIONAL EMISSIONS OF STYRENE FROM S-B AND SBR LATEX PRODUCTION

= (Total EF * Total SBR latex produced) + (Total EF * 2 * Total S-B latex produced)

= (1.34 lb styrene/ton resin * 47,000 tons SBR latex) + (1.34 lb styrene/ton resin * 2 * 520,000 tons S-B latex)

= 62,980 lb styrene from SBR latex prod. + 1,393,600 lb styrene from S-B latex prod.

= <u>728</u> <u>tons styrene from uncontrolled S-B and SBR latex production</u>

EMISSIONS ALLOCATION TO FACILITIES

Company	Location	Capacity MM lbs	Type of Product	Emissions tons	State FIP Code	County FIP Code
BASF Corp.	Chattanooga, TN	110	S-B latex	68	47	065
	"	64	SBR latex	13	"	"
	"		Total	81	"	"
	Monaca, PA	55	S-B latex	34	42	007
Dow Chemical (a)	Dalton, GA	80	S-B latex	49	13	313
	Freeport, TX	80	S-B latex	49	48	039
	Gales Ferry, CT	80	S-B latex	49	09	011
	Midland, MI	80	S-B latex	49	26	111
	Pittsburg, CA	80	S-B latex	49	42	003
GenCorp Polymer	Mogadore, OH	187	S-B latex	116	39	153
	"	15	SBR latex*	3	"	"
	"		Total	119	"	"
BF Goodrich Chem.	Akron, OH	2	S-B latex	1.2	39	153
	"	2	SBR latex**	0.4	"	"
	"		Total	2	"	"
Goodyear Tire & Rub.	Akron, OH	7	SBR latex**	1.5	39	153
	Calhoun, GA	88	S-B latex	54	13	129
	"	12	SBR latex*	3	"	"
	"		Total	57	"	"
	Houston, TX	50	SBR latex	10	48	201
W.R. Grace	Owensboro, KY	10	S-B latex	6	21	059
Reichhold Chem. (a)	Cheswold, DE	77	S-B latex	48	10	001
	Kensington, GA	77	S-B latex	48	13	295
Colloids, Inc.	Gastonia, NC	35	S-B latex	22	37	071
Unocal Chemicals	Charlotte, NC	60	S-B latex	37	37	119
	La Mirada, CA	27	S-B latex	17	06	037
TOTAL	18 facilities	1278	Both	728		
		1128	S-B latex only			
		150	SBR latex only			

(a) An overall capacity was reported for these 2 companies' plants (Dow: 400 MM lbs, Reichhold: 154 MM lbs). Capacities and emissions were assumed to be equally distributed among the plants.

*capacity includes styrene-butadiene-vinylpyridine latex

**capacity is all styrene-butadiene-vinylpyridine latex

Methodology:

Emission estimates for tetrachloroethylene manufacturing are based on emission factors from the Factor Information Retrieval (FIRE) System Database[1]. The chloroform emission factor applies to facilities producing tetrachloroethylene (also called perchloroethylene or PERC). The ethylene dichloride (EDC) emission factors apply to facilities coproducing PERC and carbon tetrachloride (carbon tet). The vinyl chloride and vinylidene chloride emission factors apply to facilities coproducing PERC and trichloroethylene (TCE).

To estimate emissions, 1990 production at each facility was needed. The "1990 Directory of Chemicals Producers"[2] provides a list of facilities and their production capacity. However no facility-specific annual production data is provided. Instead, this was estimated using the facility-specific capacity data[2] and the ratio of total annual production and total annual capacity reported in the "Chemical Products Synopsis" series for each of the industries.[3-5] The facility emission estimates for each chemical were summed to produce the 1990 national estimates.

Data Qualifiers:
Emission factors were only available for certain emission points, so the estimates may underestimate the amount of emissions from this source category. Also note that the capacities reported in the two references did not match. No adjustments were made, both references were used as published.

The emission factor for chloroform represents an emission point controlled with a condenser. Control practices are unknown; therefore this may underestimate emissions from this source.

Emission factors for EDC represent the hydrocarbon chlorinolysis process, hex waste handling at facilities coproducing PERC and carbon tet. Factors for uncontrolled sources and for sources controlled with activated carbon adsorption and miscellaneous control devices are listed. Since control practices are unknown, an average of the uncontrolled and controlled emission factors was used to estimate emissions. Because emission factors are specific to coproduction facilities, estimates were only calculated for those facilities identified in the "Directory of Chemical Producers" to produce both PERC and carbon tetrachloride.

The emission factor for vinyl chloride represents uncontrolled emissions from the oxychlorination process drying column vent. The emission factor is specific to facilities coproducing PERC and TCE. Consequently, an estimate was only calculated for the one facility identified in the "Directory of Chemical Producers" that coproduces PERC and TCE.

The emission factors for vinylidene chloride represent uncontrolled and controlled emissions from a PERC distillation vent spray scrubber. Since control practices are unknown, an average was used to estimate emissions.

Calculations:
Ratio of 1990 PERC Production to Annual PERC Production Capacity:
(371 million lb PERC produced in 1990)/(630 million lb capacity to produce PERC) = 0.5889

Example calculation to estimate 1990 production at one facility:
0.5889 x 200 million lb capacity to produce PERC = 117.78 million lb produce PERC by one facility in 1990

Chloroform emissions estimate for one facility:
emissions = PERC production x emission factor
= 117.78 million lbs PERC produced x (1 ton/2000 lb) x 0.24 lbs chloroform/ton PERC produced
= 14133.6 lbs chloroform x (1 ton / 2000 lbs)
= 7.0668 tons chloroform emitted at one facility

References:
1. U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.
2. 1990 Directory of Chemical Producers. SRI International. Menlo Park, CA. 1990. p 520, 832, 1047.
3. Mannsville Chemical Products Corporation. Chemical Product Synopsis - Carbon Tetrachloride. October 1992.
4. Mannsville Chemical Products Corporation. Chemical Product Synopsis - Perchloroethylene. August 1992.
5. Mannsville Chemical Products Corporation. Chemical Product Synopsis - Trichloroethylene. May 1995.

APPENDIX A: NATIONAL ESTIMATES - Chemical Manufacturing: Tetrachloroethylene

Methodology:

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	Chloroform Emission Factor	Chloroform Emissions (tons/year)	State FIP Code	County FIP Code
Dow Chemical	Pittsburg, CA	50	29.445	0.24	1.77	06	013
Dow Chemical	Plaquemine, LA	90	53.001	0.24	3.18	22	047
Occidental Chemical Corp	Deer Park, TX	180	106.002	0.24	6.36	48	201
PPG Industries Chemicals Group	Lake Charles, LA	200	117.78	0.24	7.07	22	019
Vulcan Chemicals	Geismar, LA	150	88.335	0.24	5.30	22	005
Vulcan Chemicals	Wichita, KS	50	29.445	0.24	1.77	20	173
1990 Annual Emission Estimate =			25.44	tons chloroform/ year			

Emission Factor Units = lb chloroform / ton PERC produced

Methodology:

Facility Name	Facility Location	1990 Annual Capacity PERC (million lbs)	1990 Annual Capacity CCL4 (million lbs)	1990 Annual Production (million lbs)	EDC Emission Factor	EDC Emissions (tons/year)	State FIP Code	County FIP Code
Dow Chemical	Pittsburg, CA	50	80	99.52	0.0286	0.71	06	013
Dow Chemical	Plaquemine, LA	90	125	167.375	0.0286	1.20	22	047
Occidental Chemical Corp	Deer Park, TX	180		180	0.0286	0.00	NA	NA
PPG Industries Chemicals Group	Lake Charles, LA	200		200	0.0286	0.00	NA	NA
Vulcan Chemicals	Geismar, LA	150	90	205.71	0.0286	1.47	22	005
Vulcan Chemicals	Wichita, KS	50	60	87.14	0.0286	0.62	20	173
	1990 Annual Emission Estimate =			4.00	ton EDC / year			

Emission Factor Units = lb EDC / ton PERC & CCL4 produced

Methodology:

Approach: Appropriate emission factors from the document "Locating and Estimating Air Emissions from Sources of Ethylene Dichloride", were multiplied by an estimate of annual chemical production at each facility reported in the "1990 Directory of Chemicals Producers" to produce trichloroethylene (also called trichloroethene or TCE). The 1990 production of TCE was estimated by dividing the total annual production by total annual capacity for 1990, as reported in "Chemical Products Synopsis - Trichloroethylene", May, 1995. This factor was then multiplied by the capacity of each facility identified in the "1990 Directory of Chemical Producers" to estimate the production at each facility. Note that the sum of the capacities for each facility from Reference 3 does not match the total capacity reported in Reference 2.

The facility estimates for each chemical were summed individually to produce the 1990 national estimate of emissions from chemical manufacturing of trichloroethylene. Spatial allocation of the estimates for each chemical was based on the location of each facility identified in the "1990 Directory of Chemical Producers".

Data Qualifiers:
The ethylene dichloride emission factor from the L & E document, (5.0 kg EDC / Mg TCE produced) is applicable to controlled emissions from the production of TCE. This factor was calculated for the L & E document by dividing the 1977 reported TCE emissions by 90 percent of the total TCE production quantity in 1977.

Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emission from this source category.

Example Calculations:
Percent of Annual Production Capacity for TCE:
183 (million lbs TCE produced) / 230 (million lbs total capacity to produce TCE) = 0.79565

For one facility, 1990 total production estimated as:
0.79565 x 120 (million lbs capacity to produce TCE , 1990) = 95.478 million lbs TCE produced at a facility

Emission Factor:
5.0 (kg EDC / Mg TCE produced) x 1 Mg/1 metric ton x 1 metric ton/2200 lbs x 2000 lbs/ short ton= 4.545 kg/ton
4.545 (kg EDC / ton TCE produced) x 1.102E-3 / 1 kg = 0.0050091 tons EDC / ton TCE produced
0.0050091 tons EDC / ton TCE produced x 2000 lbs / ton = 10.018 lbs EDC / ton TCE produced

Emissions Estimate:
95.478 (million lbs TCE produced) x (1 ton / 2000 lbs) x 10.018 EDC / ton TCE produced =
= 485993 lbs TCE from chemical manufacturing of TCE x (1 ton / 2000 lbs) =
= 242.99 tons TCE from chemical manufacturing of TCE at one facility.

Trichloroethylene and Vinylidene Chloride Emissions

The same methodology used to calculate ethylene dichloride emissions was used to calculate trichloroethylene. For vinylidene chloride emissions, the emission factor only applies to facilities that coproduce TCE and tetrachloroethylene (PERC). Thus a somewhat different approach was used which combined production and capacity data for the one facility that coproduces TCE and PERC. Tables 1-3 (attached) contain the emission calculations.

References:
1. U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Ethylene Dichloride. EPA-450/4-84-007d. Research Triangle Park, North Carolina. Printed from AIR CHIEF.
2. SRI International. 1990 Directory of Chemical Producers. Menlo Park, CA. 1990. p 1047.
3. Mannsville Chemical Products Corporation. Chemical Product Synopsis - Trichloroethylene. May 1995.

APPENDIX A: NATIONAL ESTIMATES - Chemical Manufacturing: Trichloroethylene

Methodology:

Table 1: Ethylene Dichloride (EDC) Emissions

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	EDC Emission Factor (lb/ton TCE produced)	Cont EDC Emissions (ton/year)	State FIP Code	County FIP Code
Dow Chemical	Freeport, TX	120	95.48	10.18	242.99	48	039
PPG Chemicals Group	Lake Charles, LA	200	159.13	10.18	404.99	22	019
1990 Annual Emission Estimate =			647.98	tons EDC / year from chemical manufacturing TCE			

Table 2: Trichloroethylene Emissions

Facility Name	Facility Location	1990 Annual Capacity (million lbs)	1990 Annual Production (million lbs)	TCE Emission Factor (lb/ton TCE produced)	TCE Emissions (ton/year)	State FIP Code	County FIP Code
Dow Chemical	Freeport, TX	120	95.48	0.3944	9.41	48	39
PPG Chemicals Group	Lake Charles, LA	200	159.13	0.3944	15.69	22	19
1990 Annual Emission Estimate =			25.1	tons TCE / year from chemical manufacturing TCE			

Table 3: Vinylidene Chloride Emissions

Facility Name	Facility Location	PERC Capacity (million lbs)	TCE Capacity (million lbs)	TCE Production (million lbs)	Vinylidene Chloride EF	Vinylidene Chloride (ton/year)	FIP Code	FIP Code
Dow Chemical	Freeport, TX	0	120	0	1.55405	0	NA	NA
PPG Industries Chemicals Group	Lake Charles, LA	200	200	257.68	1.55405	100.11	22	19
1990 Annual Emission Estimate =				100.111901	tons vinylidene chloride per year			

Emission factor units = lb vinylidene chloride / ton PERC & TCE produced

Methodology:

ESTIMATE OF CARBON TETRACHLORIDE, HYDROGEN CHLORIDE, CHLORINE, AND MERCURY EMISSIONS FROM CHLORINE PRODUCTION

Approach: Estimates (1992 base year) of 13.0, 9.4, 37.2, and 6.4 tons per year of carbon tetrachloride (C. T.), hydrogen chloride, chlorine, and mercury emissions respectively, from chlorine production were documented in the May 16, 1997 "Technical Information Project Summary" (TIPS).[1] This summary was provided by the EPA for this inventory.

The TIP summary reports there were 40 chlorine production facilities in 1992.[1] The "1990 Directory of Chemical Producers" lists 51 facilities operating in 1990.[2] The EPA estimate of emissions for carbon tetrachloride, hydrogen chloride, and chlorine emissions were scaled up from 40 facilities to 51 facilities by multiplying the national estimate by 1.275 (51 facilities/40 facilities). Furthermore, the estimates were scaled from 1992 to 1990 estimates by multiplying by a national chlorine production ratio developed from data found in the "Chemical Products Synopsis - Chlorine."[3] Spatial allocation of the emissions was based on the location of the facilities identified the "1990 Directory of Chemical Producers" because it reflects 1990 activities. Emissions of carbon tetrachloride, hydrogen chloride, and chlorine were allocated to each facility by multiplying the annual estimate by the ratio of the facility capacity to the total industry capacity.

The Emissions Inventory of Section 112 (c)(6) Pollutants, June 1997, indicates the mercury estimate was based on Section 114 questionnaire responses from 13 facilities.[4] It is assumed the 13 facilities were the only facilities out of 40 that reported mercury emissions. The "1990 Directory of Chemical Producers" reports there were 20 chlorine facilities of the mercury cell process type.[2] Since the mercury cell process type is the only chloralkali process that emits mercury, spatial allocation of the emissions was based on the location of the 20 facilites identified the "1990 Directory of Chemical Producers."

Data Qualifier: Facility specific information was not available so the emissions allocated to specific counties may be an under or over estimate of emissions. The facility estimates are based on facility capacity, not actual production data.

Emissions Calculations:
13.0 tons C.T./year x (51 total facilities/40 facilities in TIPS) = 16.58 tons C. T./year (1992)
16.58 tons C. T. (1992)/year x (11846 tons chlorine 1990/11656 tons chlorine 1992) = 16.85 tons C. T./year (1990)
2190000 tons facility capacity / 12366000 tons total industry capacity = 0.177098
0.177098 x 16.85 tons carbon tetrachloride / year = 2.98 tons carbon tetrachloride / year from a facility

References:

1. U.S. Environmental Protection Agency. Technical Information Project Summary. May 16, 1997. p.10.

2. SRI International. 1990 Directory of Chemical Producers. Menlo Park, CA. pp. 527 - 528.

3. Mannsville Chemical Products Corporation. Chemical Products Synopsis - Chlorine. March 1997.

4. U. S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM); 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF); Polychlorinated Biphenyl Compounds (PCBs); Hexachlorbenzene; Mercury; and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

APPENDIX A: NATIONAL ESTIMATES - Chlorine Production

Methodology:

Carbon Tetrachloride (C.T.), HCL, and Chlorine Emissions from Chlorine Production

Facility Name	Facility Location	Capacity (1000 tons)	Capacity Wt. Factor	C.T. Emiss (tons/yr)	HCL Emiss (tons/yr)	CL2 Emiss (tons/yr)
Akzo America Chemical Div	Le Moyne, Al	78	0.01	0.11	0.08	0.30
Atochem North America	Portland, OR	150	0.01	0.20	0.15	0.58
Atochem North America	Tacoma, WA	91	0.01	0.12	0.09	0.35
Bayer USA, Mobay Corp	Baytown, TX	90	0.01	0.12	0.09	0.35
Dow Chemical USA	Freeport, TX	2190	0.18	2.98	2.16	8.54
Dow Chemical USA	Pittsburg, CA	146	0.01	0.20	0.14	0.57
Dow Chemical USA	Plaquemine, LA	1157	0.09	1.58	1.14	4.51
DuPont Chemicals & Pigments	Niagara Falls, NY	85	0.01	0.12	0.08	0.33
Formosa Plastics	Baton Rouge, LA	198	0.02	0.27	0.20	0.77
Fort Howard Corp	Green Bay, WI	9	0.00	0.01	0.01	0.04
Fort Howard Corp	Muskogee, OK	6	0.00	0.01	0.01	0.02
GE Plastics	Burkville, AL	26	0.00	0.04	0.03	0.10
GE Plastics	Mount Vernon, Al	55	0.00	0.07	0.05	0.21
Georgia Gulf	Plaquemine, LA	425	0.03	0.58	0.42	1.66
Georgia Pacific Chemical Div	Bellingham, WA	90	0.01	0.12	0.09	0.35
Georgia Pacific Chemical Div	Brunswick, GA	53	0.00	0.07	0.05	0.21
BF Goodrich Chemical Group	Calvert City, KY	120	0.01	0.16	0.12	0.47
Hanlin Group, LCP Chemicals	Acme, NC	53	0.00	0.07	0.05	0.21
Hanlin Group, LCP Chemicals	Brunswick, GA	106	0.01	0.14	0.10	0.41
Hanlin Group, LCP Chemicals	Moundsville, WV	87	0.01	0.12	0.09	0.34
Hanlin Group, LCP Chemicals	Orrington, ME	80	0.01	0.11	0.08	0.31
Hanlin Group, LCP Chemicals	Syracuse, NY	91	0.01	0.12	0.09	0.35
La Roche Chemicals	Gramercy, LA	200	0.02	0.27	0.20	0.78
Lin Chem Inc	Ashtabula, OH	40	0.00	0.05	0.04	0.16
Niachlor Inc	Niagara Falls, NY	220	0.02	0.30	0.22	0.86
Occidental Chemical Corp	Convent, LA	307	0.02	0.42	0.30	1.20
Occidental Chemical Corp	Corpus Christi, TX	460	0.04	0.63	0.45	1.79
Occidental Chemical Corp	Deer Park, TX	383	0.03	0.52	0.38	1.49
Occidental Chemical Corp	Delaware City, DE	139	0.01	0.19	0.14	0.54
Occidental Chemical Corp	La Porte, TX	529	0.04	0.72	0.52	2.06
Occidental Chemical Corp	Mobile, AL	37	0.00	0.05	0.04	0.14
Occidental Chemical Corp	Muscle Shoals, AL	146	0.01	0.20	0.14	0.57
Occidental Chemical Corp	Niagara Falls, NY	323	0.03	0.44	0.32	1.26
Occidental Chemical Corp	Tacoma, WA	223	0.02	0.30	0.22	0.87
Occidental Chemical Corp	Taft, LA	628	0.05	0.86	0.62	2.45
Olin Chemicals	Augusta, GE	112	0.01	0.15	0.11	0.44
Olin Chemicals	Charlestown, TN	254	0.02	0.35	0.25	0.99
Olin Chemicals	McIntosh, AL	365	0.03	0.50	0.36	1.42
Olin Chemicals	Niagara Falls, NY	90	0.01	0.12	0.09	0.35
Oregon Metallurgical Corp	Albany, OR	2	0.00	0.00	0.00	0.01
Pioneer Chlor Alkali Company	Henderson, NV	115	0.01	0.16	0.11	0.45
Pioneer Chlor Alkali Company	St. Gabriel, LA	176	0.01	0.24	0.17	0.69
PPG Industries Chemical Group	Lake Charles, LA	1148	0.09	1.56	1.13	4.47
PPG Industries Chemical Group	Natrium, WV	345	0.03	0.47	0.34	1.34
Renco Group, Magnesium Corp of America	Rowley, UT	15	0.00	0.02	0.01	0.06
RMI Company	Ashtabula, OH	40	0.00	0.05	0.04	0.16
Trans Resources Inc, Cedar Chemical Corp	Vicksburg, MS	36	0.00	0.05	0.04	0.14
Vulcan Chemicals	Geismar, LA	243	0.02	0.33	0.24	0.95
Vulcan Chemicals	Port Edwards, WI	72	0.01	0.10	0.07	0.28
Vulcan Chemicals	Wichita, KS	182	0.01	0.25	0.18	0.71
Weyerhauser Company	Longview, WA	150	0.01	0.20	0.15	0.58
TOTAL		12366	1.00	16.85	12.18	48.20

National Emissions Data		C.T.	HCL	CL2
1992 National Emissions*(51/40)	(tons)=	16.58	11.99	47.43
1990 Chlorine Production	(tons)=	11846.00	11846.00	11846.00
1992 Chlorine Production	(tons)=	11656.00	11656.00	11656.00
1990 National Emissions*(51/40) (calculated)	(tons)=	16.85	12.18	48.20

Methodology:

Mercury Emissions from Chlorine Production

Facility Name	Facility Location		Capacity (1000 tons)	Capacity Weighting Factor	Mercury Emissions (tons/yr)	State FIP Code	County FIP Code
Akzo America Chemical Div	Le Moyne, Al		78	0.86	0.00	01	097
Georgia Pacific Chemical Div	Bellingham, WA		90	0.99	0.00	53	073
BF Goodrich Chemical Group	Calvert City, KY		120	1.32	0.00	21	157
Hanlin Group, LCP Chemicals	Acme, NC		53	0.58	0.00	37	019
Hanlin Group, LCP Chemicals	Brunswick, GA		106	1.16	0.00	13	127
Hanlin Group, LCP Chemicals	Moundsville, WV		87	0.96	0.00	54	051
Hanlin Group, LCP Chemicals	Orrington, ME		80	0.88	0.00	23	019
Hanlin Group, LCP Chemicals	Syracuse, NY		91	1.00	0.00	36	067
Lin Chem Inc	Ashtabula, OH		40	0.44	0.00	39	007
Occidental Chemical Corp	Deer Park, TX		383	4.21	0.00	48	201
Occidental Chemical Corp	Delaware City, DE		139	1.53	0.00	10	003
Occidental Chemical Corp	Mobile, AL		37	0.41	0.00	01	097
Occidental Chemical Corp	Muscle Shoals, AL		146	1.60	0.00	01	033
Olin Chemicals	Augusta, GE		112	1.23	0.00	13	245
Olin Chemicals	Charlestown, TN		254	2.79	0.00	47	011
Olin Chemicals	Niagara Falls, NY		90	0.99	0.00	36	063
Pioneer Chlor Alkali Company	St. Gabriel, LA		176	1.93	0.00	22	047
PPG Industries Chemical Group	Lake Charles, LA		1148	12.62	0.00	22	019
PPG Industries Chemical Group	Natrium, WV		345	3.79	0.00	54	103
Vulcan Chemicals	Port Edwards, WI		72	0.79	0.00	55	141
TOTAL			3647	40.08	0.00		

1992 National Hg Emissions	(tons)=	9.8
1990 Chlorine Production	(tons)=	11846
1992 Chlorine Production	(tons)=	11656
1990 National Hg Emissions (calculated)	(tons)=	9.96

Methodology:

The national chromium emission estimates for (1) hard chromium plating; (2) decorative chromium plating; and (3) chromium anodizing are from the national baseline emission estimates that were documented on December 16, 1993 in the Federal Register for the proposed NESHAP for chromium electroplating and chromium anodizing tanks (Reference 1).

Reference:

1. National Emission Standards for Hazardous Air Pollutants; Proposed Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks. Federal Register 58. Page 65768. December 16, 1993.

Methodology:

Nationwide Chromium Emission Estimate (tons/year) (a)

Type of Operation	Small Plant (<60 million Ah/yr)	Large Plant (>60 million Ah/yr)	TOTAL (Small and Large Plant)
	Tons Per Year	Tons Per Year	Tons Per Year
Hard Chromium Plating	20.30	139.30	159.60
Decorative Chromium Plating	0.00	11.50	11.50
Chromium Anodizing	0.00	3.90	3.90
		TOTAL:	175.00

(a) Reference:
National Emission Standards for Hazardous Air Pollutants; Proposed Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks. Federal Register 58. Page 65768. December 16, 1993.

Methodology:

16-PAH

The estimate comes from the 112(c)(6) report (U.S. EPA, 1997).

References

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

The clay products manufacturing NESHAP includes the following SIC Codes:
3251 Brick and Structural Clay Tile
3253 Ceramic Wall and Floor Tile
3259 Structural Clay Products, nec
3261 Vitreous Plumbing Fixtures
3262 Vitreous China Table and Kitchenware
3263 Semivitreous Table and Kitchenware
3264 Porcelain Electrical Supplies
3269 Potter Products, nec
3295 Clay Products Manufacturing: Minerals and Earths, Ground or Otherwise Treated

For SIC Codes 3251 and 3259, EPA provided 1995 estimates based on an unpublished draft of an AP-42 chapter for:

hydrogen fluoride
hydrochloric acid
benzene
bis(2-ethylhexyl)phthalate

EPA stated that the 1990 estimates are approximately 95 percent of the 1995 emissions (Marinshaw, 1997, Neuffer, 1997). For emissions not estimated by EPA, the draft AP-42 chapter was used to estimate the rest of the pollutants in these two SIC Codes (U. S. EPA, 1997a) for which there are emission factors. These are summarized in the attached spreadsheet.

All other pollutant estimates were taken from the 1990 TRI database (U.S. EPA, 1997b). For SIC Code 3295, emissions are based on 1990 TRI data for the SIC Code with adjustments made for the facilities that are not to be subject to the NESHAP (see next page).

The 1990 base year emission estimates for SIC 3295 (minerals, ground and treated) were taken from the US EPA Toxic Release Inventory (TRI). SIC 3295 included emissions for hazardous waste-burning lightweight aggregate kilns, which is included in a different NESHAP than the clay products manufacturing NESHAP. A facility list for hazardous waste-burning lightweight aggregate kilns in SIC 3295 was provided by US EPA. Emissions reported in TRI for these facilities were subtracted from the emission totals for SIC 3295. The table below lists the facilities from SIC 3295 which are not subject to the clay products manufacturing NESHAP and were not included in the 1990 base year national emission inventory.

Hazardous Waste Burning Lightweight Aggregate Kilns Not Subject to the Clay Products Manufacturing MACT Standard

Facility	Location	EPA ID	Comment
Norlite	Cohoes, NY	NYD080469935	
Solite	Green Cove Springs, FL	FLD004059085	Stopped burning hazardous waste in 1996
Solite	Brooks, KY	KYD059568220	
Solite	Norwood, NC	NCD003152642	
Solite	Arvonia, VA	VAD042755082	
Solite	Cascade, VA	VAD046970521	
Featherlite	Ranger, TX	TXD988040747	Filed for RCRA interim status, no indication that facility ever burned hazardous waste, not considered part of hazardous waste universe.

Methodology:

References

1. Marinshaw, Rick, Midwest Research Institute, to Bill Neuffer, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Memorandum. HAP Emission Estimates for Clay Manufacture. July 1997.

2. Neuffer, Bill, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, to Bridget Kosmicki, Eastern Research Group, Inc. Telephone conversation. Emissions from Clay Products Manufacturing. July 1997.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition. AP-42, Volume I: Stationary Point and Area Sources. Draft - Chapter 11.3 Brick and Structural Clay Product Manufacturing. Research Triangle Park, North Carolina. August 1997a.

4. U.S. Environmental Protection Agency. Toxic Release Inventory. 1987-1995 CD ROM (1990 Data). EPA-749-C-97-003. Research Triangle Park, North Carolina. August 1997b.

5. Neuffer, William. U.S. Environmental Protection Agency, Emission Standards Division. HAP Emissions Information (for clay products manufacturing) provided to Brian Hnat, Eastern Research Group, Inc. July 2, 1998.

6. Krowlewski, Mary Jo. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Facility List for Lightweight Aggregate Kilns provided to Brian Hnat, Eastern Research Group, Inc. July 7, 1998.

Methodology:

Subcategory: Structural Clay Products, NEC

1995 Activity Levels[1]	(tons/year)
Kiln, gas-fired	1.01E+07
Kiln, coal-fired	1.51E+06
Kiln, saw dust-fired	1.51E+06

	Emission Factors for Brick Manufacturing Operations[3]			1995 Emission Estimates for Brick Manufacturing Operations (see example below)					
Pollutant	Kiln, gas-fired (lb/ton produced)	Kiln, coal-fired (lb/ton produced)	Kiln, sawdust-fired (lb/ton produced)	Kiln, gas-fired (lb/year)	Kiln, coal-fired (lb/year)	Kiln, sawdust-fired (lb/year)	Total 1995 Emission (lb/year)	Total 1990 Emission (lb/year)	**Total 1990 Emission (ton/year)**
1,4-dichlorobenzene	4.8E-05	3.2E-06	0.0E+00	4.9E+02	4.8E+00	0.0E+00	4.9E+02	4.7E+02	**2.3E-01**
16-PAH	6.5E-05	1.0E-05	3.4E-04	6.6E+02	1.5E+01	5.1E+02	1.2E+03	1.1E+03	**5.6E-01**
Acrylonitrile	0.0E+00	0.0E+00	1.5E-05	0.0E+00	0.0E+00	2.3E+01	2.3E+01	2.2E+01	**1.1E-02**
Arsenic	3.1E-05	1.3E-04	3.1E-05	3.1E+02	2.0E+02	4.7E+01	5.6E+02	5.3E+02	**2.6E-01**
Beryllium	4.2E-07	1.6E-05	4.2E-07	4.2E+00	2.4E+01	6.3E-01	2.9E+01	2.8E+01	**1.4E-02**
Cadmium	1.5E-05	1.5E-05	1.5E-05	1.5E+02	2.3E+01	2.3E+01	2.0E+02	1.9E+02	**9.4E-02**
Carbon disulfide	4.3E-05	2.3E-06	1.6E-05	4.4E+02	3.5E+00	2.4E+01	4.6E+02	4.4E+02	**2.2E-01**
Carbon tetrachloride	0.0E+00	5.0E-08	1.5E-07	0.0E+00	7.6E-02	2.3E-01	3.0E-01	2.9E-01	**1.4E-04**
Chlorobenzene	0.0E+00	2.1E-05	0.0E+00	0.0E+00	3.2E+01	0.0E+00	3.2E+01	3.0E+01	**1.5E-02**
Chloroform	0.0E+00	5.0E-08	1.5E-07	0.0E+00	7.6E-02	2.3E-01	3.0E-01	2.9E-01	**1.4E-04**
Chromium	5.1E-05	5.1E-05	5.1E-05	5.2E+02	7.7E+01	7.7E+01	6.7E+02	6.4E+02	**3.2E-01**
Dibutyl phthalate	1.4E-04	0.0E+00	6.1E-06	1.4E+03	0.0E+00	9.2E+00	1.4E+03	1.4E+03	**6.8E-01**
Dimethylphthalate	0.0E+00	3.9E-07	1.0E-05	0.0E+00	5.9E-01	1.5E+01	1.6E+01	1.5E+01	**7.5E-03**
Ethylbenzene	4.4E-05	2.1E-05	8.5E-06	4.5E+02	3.2E+01	1.3E+01	4.9E+02	4.7E+02	**2.3E-01**
Iodomethane	9.3E-05	0.0E+00	2.0E-04	9.4E+02	0.0E+00	3.0E+02	1.2E+03	1.2E+03	**5.9E-01**
Isophorone	0.0E+00	3.0E-05	0.0E+00	0.0E+00	4.5E+01	0.0E+00	4.5E+01	4.3E+01	**2.2E-02**
Lead	1.5E-04	1.5E-04	1.5E-04	1.5E+03	2.3E+02	2.3E+02	2.0E+03	1.9E+03	**9.4E-01**
Manganese	2.9E-04	2.9E-04	1.3E-02	2.9E+03	4.4E+02	2.0E+04	2.3E+04	2.2E+04	**1.1E+01**
Mercury	7.5E-06	9.6E-05	7.5E-06	7.6E+01	1.5E+02	1.1E+01	2.3E+02	2.2E+02	**1.1E-01**
Methyl bromide	0.0E+00	2.4E-05	5.0E-05	0.0E+00	3.6E+01	7.6E+01	1.1E+02	1.1E+02	**5.3E-02**
Methyl chloride	6.7E-04	1.1E-04	6.8E-04	6.8E+03	1.7E+02	1.0E+03	8.0E+03	7.6E+03	**3.8E+00**
Methyl chloroform	4.7E-06	8.6E-06	1.5E-07	4.8E+01	1.3E+01	2.3E-01	6.1E+01	5.8E+01	**2.9E-02**
Methyl ethyl keytone	2.2E-04	2.5E-04	3.3E-06	2.2E+03	3.8E+02	5.0E+00	2.6E+03	2.5E+03	**1.2E+00**
Methylene chloride	0.0E+00	0.0E+00	7.5E-06	0.0E+00	0.0E+00	1.1E+01	1.1E+01	1.1E+01	**5.4E-03**
Nickel	7.2E-05	7.2E-05	7.2E-05	7.3E+02	1.1E+02	1.1E+02	9.5E+02	9.0E+02	**4.5E-01**
Phenol	8.6E-05	5.3E-05	7.2E-05	8.7E+02	8.0E+01	1.1E+02	1.1E+03	1.0E+03	**5.0E-01**
Styrene	2.0E-05	5.0E-08	2.2E-07	2.0E+02	7.6E-02	3.3E-01	2.0E+02	1.9E+02	**9.6E-02**
Toluene	1.6E-04	2.5E-04	1.1E-04	1.6E+03	3.8E+02	1.7E+02	2.2E+03	2.1E+03	**1.0E+00**
Vinyl acetate	0.0E+00	5.0E-08	1.5E-07	0.0E+00	7.6E-02	2.3E-01	3.0E-01	2.9E-01	**1.4E-04**
Xylenes	1.3E-04	1.8E-04	3.3E-05	1.3E+03	2.7E+02	5.0E+01	1.6E+03	1.5E+03	**7.5E-01**

Emission(lb/year) = 1995 Activity (tons produced/year) * Emission Factor (lb pollutant emitted/ton produced) * (95 Percent)

Methodology:

Emission estimates for Coke By-Product Recovery Plants are based on emissions reported to the Toxic Release Inventory (TRI) in 1992. TRI emissions data (based on 19 facilities) were provided by Lula Melton (EPA/ESD). Lula Melton extracted the TRI data based on facility codes for coke by-product plants that were operating in 1992.

Reference:

1. Facsimile sent by Lula Melton, U.S. EPA, to Julie H. Tucker, Eastern Research Group, Inc. on July 29, 1997.

Methodology:

Table 1: National Emissions for Coke By-Product Recovery Plants (a)

Facility	Location	Benzene	1,3-Butadiene	Chromium Compounds	16-PAH (b)	Lead Compounds	Manganese Compounds	Nickel Compounds	Styrene	Tetrachloroethylene	Trichloroethylene	Quinoline
ABC Coke	Tarrant, AL	5,926			74				41			
Acme Steel Co.	Chicago, IL	14,900			8,110				680			2,790
Bethlehem Steel	Burns Harbor, IN	10,250	250	2,250	37,500		43,000	1,850	250			250
Citizens Gas	Indianapolis, IN	33,946			14,461							
Empire Coke Co.	Holt, AL	4,479			150							
Erie Coke Corp.	Erie, PA	135			100							
Geneva Steel	Geneva, UT	11,142			6,874				5			72
Gulf States Steel	Gadsden, AL	43,136		500	4,420	500	2,250	500	4,007			14,623
LTV Steel Corp.	South Chicago, IL	24,000			500				5			5
LTV Steel Corp.	Warren, OH	57,000		180	620		20,000		23	48,000		20
LTV Steel Corp.	Pittsburgh, PA	83,000			1,600				120			47
National Steel	Ecorse, MI	3,142		250	332	1,200	14,300				54,408	
New Boston Coke	New Boston, OH	55,250			5,916				1,066			
Shenango, Inc.	Pittsburg, PA	11,592			20,978							
Sloss Industries	Birmingham, AL	R			R							
Tonawanda Coke	Tonawanda, NY	603			603							
USS	Gary, IN	115,000		5,500	52,080		367,000	2,480				
USS	Clairton, PA			30			8,305	9				
Wheeling-Pitts. Steel	Follansbee, WV			0				0				
TOTAL (lbs/year):		473,501	250	8,710	154,318	1,700	454,855	4,839	6,197	48,000	54,408	17,807
TOTAL (tons/year):		236.75	0.13	4.36	77.16	0.85	227.43	2.42	3.10	24.00	27.20	8.90

NOTE:

R= TRI emissions for this facility include both coke by-product plant and chemical specialty plant. Emissions from only coke by-product plant are not available.

(a) These emission estimates are from 1992 Toxic Release Inventory (TRI). ESD extracted these emission estimates based on facility codes for coke by-product recovery plants that were operating in 1992. Emissions data could not be extracted from the 1990 TRI database because data identifying which plants were operating in 1990 are not readily available.

(b) Includes only Anthracene and Naphthalene.

Methodology:

ESTIMATE OF BENZENE, 16-PAH, AND COKE OVEN EMISIONS FROM COKE OVENS: CHARGING, TOP SIDE, AND DOOR LEAKS

In 1990, 3.86E+07 tons of coal were charged to coke ovens in the United States.[1] The number of facilities was obtained from EPA.[2]

The emission estimate for **benzene** was calculated by developing a national emission estimate for Benzene Soluble Organics (BSO). The BSO emission factors, which are documented in Draft AP-42,[3] reflect pre-NESHAP controls. A ratio of benzene to BSO was then applied to the BSO estimate to derive the national emission estimate for benzene Calculations are shown on the following pages.

The emission factors for the **16-PAH** group (2.79E-02 lb/ton) and **7-PAH** group (3.72E-03 lb/ton) were developed from the BSO emission factors for coke oven charging, door leaks, lid leaks, and offtake leaks. National emissions are calculated as:
NATIONAL ACTIVITY x EMISSION FACTOR = NATIONAL EMISSIONS

National **coke oven emission** estimates for the following two coke oven source categories were provided by EPA. These Base Year 1990 emission estimates, which were documented by EPA[4] using Mg/year units, are converted to tons/year as follows:

1. Doors, Lids, Offtakes, and Charging = 750 Mg of coke oven emissions/year

(750 Mg coke oven emissions/year) x (1000 kg/Mg) x (2.2046 lbs/kg) x (ton/2000 lbs) =
= 826.73 Tons coke oven emissions/year

2. Emergency Releases = 850 Mg of coke oven emissions/year

(850 MG coke oven emissions/year) x (1000 kg/Mg) x (2.2046 lbs/kg) x (ton/2000 lbs) =
= 936.96 Tons coke oven emissions/year

References:

1. Energy Information Administration. “Coke Plant Report-Quarterly.” Form EIA-5. Coke and Breeze Production at Coke Plants. 1990 Year End Estimates. Washington, D.C. 1990.

2. U.S. Environmental Protection Agency. National Urban Area Source Emissions of Benzene, 1,3-Butadiene, Formaldehyde, Trichloroethylene, Perchloroethylene, Methylene Chloride, and Carbon Tetrachloride. Final Report. Research Triangle Park, North Carolina. March 1996.

3. U.S. Environmental Protection Agency. *Compilation of Air Pollution Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42*. Draft: Section 12.2: Coke Production. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. May, 1995.

4. Personal communication between Julie H. Tucker, Eastern Research Group, Inc., and Amanda Agnew, Environmental Protection Agency, on July 1, 1997.

APPENDIX A: NATIONAL ESTIMATES - Coke Ovens: Charging, Top Side, and Door Leaks

Methodology:

Benzene Emissions

Coke Oven Emission Source	***BSO Emission Factor**	Emission Factor Units	Emission Factor Reference	Activity Data	Activity Data Units	Activity Data Reference	1990 Base Year Emission Estimates	
Charging	0.0053	coal charged	1	3.86E+07	tons of coal charged/year	2	204,580	lbs BSO/yr
Door Leaks	0.022	coal charged	1	3.86E+07	tons of coal charged/year	2	849,200	lbs BSO/yr
Lid Leaks	0.0071	coal charged	1	3.86E+07	tons of coal charged/year	2	274,060	lbs BSO/yr
Offtake Leaks	0.0066	coal charged	1	3.86E+07	tons of coal charged/year	2	254,760	lbs BSO/yr
						TOTAL:	1,582,600	lbs BSO/yr
		Using the	Conversion: 2000 lbs = 1 ton -------->			TOTAL:	791.30	tons BSO/yr

*** Emission factors reflect pre-NESHAP controls**

Benzene emission estimates are derived from the final BSO emission estimate (see above) by multiplying the pollutant-BSO ratio documented in the Draft AP-42 document (Reference 1) to the final BSO estimate. This calculation is shown in the following table:

Coke Oven Emission Source	1990 Base Year BSO Emissions (Tons/yr)	Benzene ratio to BSO	1990 Base Year Benzene Emissions (Tons/yr)
Charging, Door Leaks, Lid Leaks, and Offtake Leaks	791.30	0.5	395.65

References:

1. Draft Table 12.2.2 from Draft AP-42, Section 12.2: Coke Production, May, 1995

2. Energy Information Administration. "Coke Plant Report-Quarterly." Form EIA-5. Coke and Breeze Production at Coke Plants. 1990 Year End Estimates. Washingotn, D.C. 1990.

Methodology:

Polycyclic Organic Matter as 16-PAH and 7-PAH Emissions

Table 1

BSO EMISSION FACTORS FOR COKE OVEN CHARGING, TOPSIDE, AND DOOR LEAKS (a)

Emission factors reflect Pre-NESHAP controls

Emission Source	BSO Emission Factor (lb/ton)
Charging	5.30E-03
Door Leaks	2.20E-02
Lid Leaks	7.10E-03
Offtake Leaks	6.60E-03

(a) Emission factors are from Draft Table 12.2-2 of Draft AP-42, Section 12.2: Coke Production, May, 1995.

Table 2

The emission factor for each PAH below is calculated by multiplying the PAH's percent of BSO (shown below) by the BSO emission factor listed above in Table 1 for the respective emission source.

SPECIATION OF BSO EMISSION FACTORS

PAH	7 or 16 PAH	Percent of BSO	Charging	Door Leaks	Lid Leaks	Offtake Leaks
	(a)	(b)	Emission Factor Units: lbs of PAH/tons coal charged			
Benz(a)anthracene	7,16	1.91%	1.01E-04	4.20E-04	1.36E-04	1.26E-04
Benzo(a)pyrene	7,16	1.38%	7.31E-05	3.04E-04	9.80E-05	9.11E-05
Benzo(b)fluoranthene	7,16	1.71%	9.06E-05	3.76E-04	1.21E-04	1.13E-04
Benzo(j+k)fluoranthene	7,16	1.22%	6.47E-05	2.68E-04	8.66E-05	8.05E-05
Chrysene/Triphenylene	7,16	2.04%	1.08E-04	4.49E-04	1.45E-04	1.35E-04
Dibenz(a,h)anthracene	7,16	0.16%	8.48E-06	3.52E-05	1.14E-05	1.06E-05
Indeno(1,2,3,-cd)pyrene	7,16	0.65%	3.45E-05	1.43E-04	4.62E-05	4.29E-05
Acenaphthene	16	1.18%	6.25E-05	2.60E-04	8.38E-05	7.79E-05
Acenaphthylene	16	5.70%	3.02E-04	1.25E-03	4.05E-04	3.76E-04
Anthracene	16	3.42%	1.81E-04	7.52E-04	2.43E-04	2.26E-04
Benzo(g,h,i)perylene	16	0.61%	3.23E-05	1.34E-04	4.33E-05	4.03E-05
Fluoranthene	16	6.23%	3.30E-04	1.37E-03	4.42E-04	4.11E-04
Fluorene	16	3.91%	2.07E-04	8.60E-04	2.78E-04	2.58E-04
Naphthalene (c)	16	20.00%	1.06E-03	4.40E-03	1.42E-03	1.32E-03
Phenanthrene	16	13.6%	7.21E-04	2.99E-03	9.66E-04	8.98E-04
Pyrene	16	4.28%	2.27E-04	9.42E-04	3.04E-04	2.82E-04
7-PAH Emission Factor for each emission source----			4.81E-04	2.00E-03	6.44E-04	5.99E-04
16-PAH Emission Factor for each emission source ---			3.60E-03	1.50E-02	4.83E-03	4.49E-03

Final Emission Factors (sum of above emission factors for charging, and door, lid, and offtake leaks)	
7-PAH Emission Factor ------->	3.72E-03
16-PAH Emission Factor ------->	2.79E-02

(a) PAHs that are 7- and/or 16-PAH.
(b) Table 4.7-1 of "Locating and Estimating Air Emissions from Sources of Polycyclic Organic Matter. Final Report." U.S. EPA. September 1996.
(c) Naphthalene is not measured as BSO. The percentage listed reflects the ratio of napththalene emissions to BSO emissions (0.2:1).

Methodology:

The emission estimates for benzene and coke oven emissions from coke ovens during emergency releases were estimated as follows. For benzene an emission factor from the draft AP-42 chapter (reference 1) was used with activity data from the Energy Information Administration (reference 2). For coke oven emissions, the estimate was provided by the U.S. EPA (reference 3).

The number of coke oven facilities was determined from a U.S. EPA report (reference 4).

References:

1. Draft Table 12.2-5 from Draft AP-42, Chapter 12: Coke Production, May, 1995.

2. Energy Information Administration. “Coke Plant Report-Quarterly.” Form EIA-5. Coke and Breeze Production at Coke Plants. 1990 Year End Estimates. Washington, DC. 1990.

3. Personal communication between Julie H. Tucker, Eastern Research Group, Inc. and Amanda Agnew, Environmental Protection Agency on July 1, 1997.

4. U.S. Environmental Protection Agency. National Urban Area Source Emissions of Benzene, 1,3-Butadiene, Formaldehyde, Trichloroethylene, Perchloroethylene, Methylene Chloride, and Carbon Tetrachloride. Final Report. Research Triangle Park, North Carolina. March 1996.

Methodology:

Coke Oven Emission Source	***Benzene Emission Factor**	Emission Factor Units	Emission Factor Reference	Activity Data	Activity Data Units	Activity Data Reference	1990 Base Year Benzene Emission Estimates
Coke Ovens: Emergency Releases	0.22	lb Benzene/tons coal charged	1	3.86E+07	tons of coal charged per year	2	8.49E+06 lbs Benzene
Using the	Conversion: 2000 lbs = 1 ton ---->					TOTAL:	4.25E+03 tons Benzene

*** Emission factor reflects a flare control device.**

References:

1. Draft Table 12.2-5 from Draft AP-42, Chapter 12: Coke Production, May, 1995

2. Energy Information Administration. "Coke Plant Report-Quarterly."
Form EIA-5. Coke and Breeze Production at Coke Plants. 1990
Year End Estimates. Washington, D.C. 1990.

Methodology:

For Polycylic Organic Matter as 16-PAH emission estimates:

Federal Register Notice: Volume 62, No. 119, June 20, 1997. (Table 1, Page 33634)

For Benzene emission estimates, see the calculations on the following page.

For number of facilities:

U.S. Environmental Protection Agency. National Urban Area Source Emissions of Benzene, 1,3-Butadiene, Formaldehyde, Trichloroethylene, Perchloroethylene, Methylene Chloride, and Carbon Tetrachloride. Final Report. Research Triangle Park, North Carolina. March 1996.

Methodology:

Benzene Emissions

Coke Oven Emission Source	**Benzene Emission Factor**	Emission Factor Units	Emission Factor Reference	Activity Data	Activity Data Units	Activity Data Reference	1990 Base Year VOC Emission Estimates	
Coke Ovens: Pushing	**0.002**	lb benz/tons coal charged	1	3.86E+07	tons of coal charged per year	2	7.72E+04	lbs Benzene
Coke Ovens: Combustion (Battery) Stacks	**0.013**	lb benz/tons coal charged	1	3.86E+07	tons of coal charged per year	2	5.02E+05	lbs Benzene
Coke Ovens: Pushing, Quenching and Battery						TOTAL:	5.79E+05	lbs Benzene
		Using the	Conversion: 2000 lbs = 1 ton ---->			**TOTAL:**	**2.90E+02**	tons Benzene

References:

1. Lula Melton, U. S. Environmental Protection Agency. Emission Standards Division. Note from Marvin Branscome. Comments on Coke Ovens information in the "Baseline Emission Inventory of HAP Emission from MACT Sources Interim Final Report," September 18, 1998. October 14, 1998.

2. Energy Information Administration. "Coke Plant Report-Quarterly." Form EIA-5. Coke and Breeze Production at Coke Plants. 1990 Year End Estimates. Washington, D.C. 1990.

Methodology:

An average emission factor provided by the EIIP report (U.S. EPA, 1996) draws from the following categories: personal care products, household products, automotive aftermarket products, adhesives and sealants, FIFRA-regulated products, coatings and related products, and misc. (not covered by the previous list) products. There are no controls on these emissions.

Emission factors came from the EIIP report (U.S. EPA, 1996).

Activity levels came from the 1990 census (U.S. Bureau of the Census, 1990).

Pollutant	Activity Data (Persons)	Emission Factor (lb/person/year)	Estimate = Activity * Emission Factor
1,3-Dichloropropene	2.49E+08	1.60E-01	19,896.79 ton/yr 39,793,580 lb/yr
1,4-Dichlorobenzene	2.49E+08	3.52E-02	4377.2938 ton/yr 8,754,587.5 lb/yr
Benzene	2.49E+08	4.72E-06	0.5869553 ton/yr 1173.9106 lb/yr
Carbon tetrachloride	2.49E+08	4.10E-10	5.099E-05 ton/yr 0.101971 lb/yr
Chloroform	2.49E+08	9.91E-04	123.23574 ton/yr 246,471.48 lb/yr
Ethylene Dichloride	2.49E+08	4.65E-06	0.5782505 ton/yr 1,156.5009 lb/yr
Formaldehyde	2.49E+08	1.26E-03	156.68722 ton/yr 313,374.44 lb/yr
Methylene Chloride	2.49E+08	3.64E-02	4523.5197 ton/yr 9,053,039.4 lb/yr
Polycyclic Organic Matter as 16-PAH	2.49E+08	4.61E-02	5732.7626 ton/yr 11,465,525 lb/yr
Tetrachloroethylene	2.49E+08	2.82E-02	3506.8092 ton/yr 7,013,618.4 lb/yr
Trichloroethylene	2.49E+08	4.86E-04	60.43499 ton/yr 120,873 lb/yr

References

U.S. Environmental Protection Agency. Consumer and Commercial Solvent Use. Final Chapter. Prepared for the Emission Inventory Improvement Program. August 1996. EPA-454//R-97-004c.

U.S. Bureau of the Census. 1990 Summary Tape File 1A, 1990 Decennial Census of Population and Housing. Washington D.C.

Methodology:

The chromium national emission estimates for (1) hard chromium plating; (2) decorative chromium plating; and (3) chromium anodizing are from the national baseline emission estimates that were documented on December 16, 1993 in the Federal Register for the proposed NESHAP for chromium electroplating and chromium anodizing tanks (Reference 1).

Reference:

1. National Emission Standards for Hazardous Air Pollutants; Proposed Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks. Federal Register 58. Page 65768. December 16, 1993.

Methodology:

Nationwide Chromium Emission Estimate (tons/year) (a)

Type of Operation	Small Plant (<60 million Ah/yr)	Large Plant (>60 million Ah/yr)	TOTAL (Small and Large Plant)
	Tons Per Year	Tons Per Year	Tons Per Year
Hard Chromium Plating	20.30	139.30	159.60
Decorative Chromium Plating	0.00	11.50	11.50
Chromium Anodizing	0.00	3.90	3.90
		TOTAL:	175.00

(a) Reference:
National Emission Standards for Hazardous Air Pollutants; Proposed Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks. Federal Register 58. Page 65768. December 16, 1993.

Methodology:

Mercury

The estimate comes from the 112(c)(6) report (U.S. EPA, 1997).

There are no controls for this estimate.

References

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Text Method

The emission estimate for lead compounds was derived from the Draft Lead L&E. The estimates for 2,3,7,8-TCDD TEQ, POM as 7-PAH, and POM as 16-PAH were taken from the 112(c)(6) report.

REFERENCES

(112(c)(6) Report)
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

U.S. Environmental Protection Agency. Locating and Estimating Air Emissions From Sources of Lead and Lead Compounds, OAQPS, Research Triangle Park, July 1996.

Methodology:

Tetrachloroethylene emissions from dry cleaning processes include vented and fugitive emissions. Emissions are controlled by a refrigerated condenser and leak detection and repair (LDAR) (U.S. EPA, 1996).

The number of facilities and estimate come from the 112(k) report (U.S. EPA, 1996).

Reference

U.S. Environmental Protection Agency. National Urban Area Source Emissions of Benzene, 1,3-Butadiene, Formaldehyde, Trichloroethylene, Perchloroethylene, Methylene Chloride, and Carbon Tetrachloride. Final Report. Research Triangle Park, North Carolina. March 1996.

Methodology:

Polycyclic Organic Matter as 16-PAH and 7-PAH estimates were from the 112(c)(6) report[1]. Estimates for Chromium, Lead, Manganese, and Nickel for this source category were taken from the Toxic Release Inventory, SIC Code = 3313, SIC Description = Electrometallurgical Products.[2]

REFERENCES

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

Flexible Polyurethane Foam Fabrication Operations

The Methylene Chloride estimates for this source category were provided by ESD.[1]

The Cyanide Compounds emission estimate for this source category is 2 tons per year. This estimate was provided by ESD.[2] The 2,4-toluene diisocyanate emission estimate for this source category is 1 ton per year. This estimate was provided by ESD.[2]

<u>Reference</u>

1. Memorandum to Eastern Research Group, Inc. from David Svensgaard, U.S. EPA/OAQPS. June 12, 1998.

2. Svensgaard, David, U.S. Environmental Protection Agency, Emission Standards Division. Note to B. Driscoll, U.S. EPA. Comments on Flexible Polyurethane Foam Fabrication Operations information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources–Interim Final Report," September 18, 1998.

Methodology:

Flexible Polyurethane Foam Production

The Methylene Chloride, Methylene Diphenyl Diisocyanate, and 2,4-Toluene Diisocyanate estimates for this source category were provided by ESD.

References

Memorandum to Eastern Research Group, Inc. from David Svensgaard U.S. EPA/OAQPS. June 12, 1998.

Methodology:

Mercury emissions were provided in the 112(c)(6) report.

REFERENCES

(112(c)(6) Report)
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

ESTIMATE OF EMISSIONS FROM CHEMICAL MANUFACTURING OF FLUOROCARBONS

Approach: An emission factor from the Factor Information Retrieval (FIRE) System Database was multiplied by the 1990 production of chlorodifluoromethane (HCFC-22) reported in "Chemical Product Synopsis - Fluorocarbons", February 1995, to estimate emissions from chemical manufacturing of HCFC-22. Spatial allocation of emissions was based on the four facility locations reported in the "1990 Directory of Chemical Producers" to produce HCFC-22. The "Chemical Product Synopsis" lists the estimated 1995 HCFC-22 capacities for each of the facilities, and it was assumed that their 1990 capacities were similar.

Data Qualifiers: The emission factor in FIRE (0.600 lb/ton fluorocarbon 22 produced) is representative of storage emissions controlled with a refrigerated condenser. It is the only emission factor available for this process, so this estimae may not include the entire amount of emissions from this source category.

Example Calculations: See next page.

References:

U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Mannsville Chemical Product Corporation. Chemical Product Synopsis - Fluorocarbons. February 1995.

SRI International. 1990 Directory of Chemical Producers. Menlo Park, CA. 1990. p 674.

Methodology:

EMISSION FACTOR FOR HCFC-22 PRODUCTION:

0.6 lb chloroform/ton HCFC-22 produced (from chemical storage)

ACTIVITY DATA FOR HCFC-22 PRODUCTION:

306 million lbs in 1990 = 153,000 tons in 1990

TOTAL NATIONAL EMISSIONS OF CHLOROFORM FROM HCFC-22 PRODUCTION

= Total EF * Total HCFC-22 produced

= (0.6 lb chloroform/ton HCFC-22) * (153,000 tons HCFC-22)

= 91,800 lb chloroform

= 45.9 tons chloroform from HCFC-22 production

CHEM93			Chloroform		
		Capacity	Emissions	State	County
Company	Location	million lbs	tons	FIP Code	FIP Code
Allied-Signal	Baton Rouge, LA	50	4.8	22	033
Atochem North America	Wichita, KS	95	9.2	20	173
Dupont	Depw ater, NJ	300	29.0	34	033
LaRoche Chemicals	Gramercy, LA	30	2.9	22	093
Total		475	45.9		

Example Calculation:

Emissions from all Allied-Signal facilities

= (Allied-Signal capacity/Total industry capacity) * Total National Chloroform Emissions

= (50 million lbs /475 million lbs) * 45.9 tons chloroform

= 4.8 tons chloroform emitted from Allied-Signal facilities in 1995

Methodology:

Emission factors for cotton ginning are available for two types of harvesting: machine stripping and machine picked (U.S. EPA, 1995). The factors are in units of lb/ton of cotton ginned. In order to calculate emissions for the two types of harvesting, activity level data was obtained from AP-42. AP-42, Section 9.7, reported a total of 19,122,000 bales produced in 1994/1995. Cotton is mechanically picked 99% of the time; 100% was assumed. Of this, machine-picked cotton accounts for 70% of the total cotton harvested and machine-stripped cotton accounts for about 30%. Based on these percentages, the total was split between the two harvesting types and emissions were calculated as shown on the next page.

References

U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Methodology:

cotton ginning			scat5					
A) Stripper-harvested cotton (accounts for about 30% of cotton harvested)								
emission factor in units of lb/ton of cotton ginned								
emission factor from FIRE for stripper-harvested cotton, avg. of range reported								
	pollutant	factor						
	arsenic	0.0174						
national emission estimates =			11.97802	tons per year				
national activity =		19122000	bales produced in 1994/1995					
stripper-harvested=		5736600	bales					
stripper-harevested=		2.75E+09	lb of cotton		assumes 480 lb/bale from AP-42			
stripper-harevested=		1376784	ton of cotton					
B) Machine-picked cotton (accounts for about 70% of cotton harvested)								
emission factor in units of 1b/ton of cotton ginned								
emission factor from FIRE for picker harvested cotton								
	pollutant	factor						
	arsenic	6.00E-04						
national emission estimates =			0.963749	tons per year				
national activity =		19122000	bales produced in 1994/1995					
picker havested=		13385400	bales					
picker harvested=		6.42E+09	lb of cotton					
picker harvested=		3212496	ton of cotton					
c) Total National emissions								
	12.94177	tons per year						

Methodology:

Emission estimates for acetaldehyde, acrolein, chloroform, and chloromethane from Formaldehyde, Acrolein, Acetaldehyde, and Butyraldehyde Production are based on emission factors from the Factor Information Retrieval (FIRE) System Database.[1]

To estimate emissions, 1990 production at each facility was needed. The *1990 Directory of Chemicals Producers*[2] provides a list of facilities and their production capacities, but does not provide facility-specific annual production data. Annual production data for each facility was estimated using facility-specific capacity data[2] and the ratio of total annual production to annual capacity (1990) as reported in *Chemical Synopsis* series for the industries.[3-4] Acetaldehyde production was used to estimate emissions for acetaldehyde, chloroform, and chloromethane. 1989 activity data were used for acetaldehyde because 1990 data were not available. Production of acrylic acid from acrolein was used to estimate acrolein emissions. The facility emission estimates were summed to produce the 1990 annual estimates. Spatial allocation for each chemical was based on the location of each facility as identified in *1990 Directory of Chemicals Producers*.[2]

Data Qualifiers

Emission factors were available only for certain emission points. Estimates may underestimate emissions from this source category. Also note that the capacities reported in the two references did not match. No adjustments were made; both references were used as published.

Emission factors in FIRE[1] for acetaldehyde, chloroform, and chloromethane represent acetaldehyde production emissions from an off-gas absorber vent controlled with a scrubber. These factors are based on data from one plant. Control practices are unknown; therefore this may not accurately estimate emissions from this source.

The acrolein emission factor in FIRE[1] represents of fugitive emissions from the production of acrolein.

Example Calculation

Ratio of 1989 acetaldehyde production to annual acetaldehyde capacity:
740 million lb acetaldehyde produced, 1989 / 850 million lb capacity to produce acetaldehyde, 1990 = 0.87059

Annual production at one facility in 1990:
Ratio of 1989 acetaldehyde production to annual acetaldehyde capacity * annual capacity of the facility
0.87059 * 500 million lb capacity = 435.29 million lb produced at one facility in 1990

Estimate for acetaldehyde emissions at one facility in 1990:
acetaldehyde production * emission factor
435.29 million lb acetaldehyde produced * 1 ton/2000 lb * 8.6 lb acetaldehyde/ton produced
= 1,871,747 lb acetaldehyde
= 935.87 ton acetaldehyde emitted at one facility

References:

1. U.S. Environmental Protection Agency. 1995 (September). Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, NC.

2. SRI International. 1990. *1990 Directory of Chemical Producers*. Menlo Park, CA.

3. Mannsville Chemical Products Corporation. 1990 (May). *Chemical Product Synopsis - Acetaldehyde*.

4. Mannsville Chemical Products Corporation. 1992 (August). *Chemical Products Synopsis - Acrylic Acid*.

APPENDIX A: NATIONAL ESTIMATES - Formaldehyde, Acrolein, Acetaldehyde, Butyraldehyde Production

Methodology:

Table 1: 1990 Acetaldehyde Emissions from Formaldehyde, Acrolein, Acetaldehyde, and Butyraldehyde Production

Facility Name	Facility Location	1990 Annual Capacity to Produce Acetaldehyde (million lbs)	1990 Annual Production of Acetaldehyde (million lbs)	Acetaldehyde Emission Factor*	Acetaldehyde Emissions (tons/yr)	State FIP Code	County FIP Code
Texas Eastman Co	Longview , TX	500.00	435.30	8.60	935.88	48	183
Hoechst Celanese Commodity Chemicals	Bay City, TX	250.00	217.65	8.60	467.94	48	321
1990 Acetaldehyde Emission Estimate =	**1,403.83**	**tons acetaldehyde/year from production of acetaldehyde**					

*Emission factor units = lb acetaldehyde / ton acetaldehyde produced

Table 2: 1990 Acrolein Emissions from Formaldehyde, Acrolein, Acetaldehyde, and Butyraldehyde Production

Facility Name	Facility Location	1990 Annual Capacity to Produce Acrolein (million lbs)	1990 Annual Production of Acrolein (million lbs)	Acrolein Emission Factor*	Acrolein Emissions (tons/yr)	State FIP Code	County FIP Code
BASF Chemicals Division	Freepoort, TX	300.00	184.41	1.90	87.59	48	39
Hoechst Celanese Corp	Clear Lake, TX	450.00	276.61	1.90	131.39	48	167
Rohm & Haas Texas	Deer Park, TX	420.00	258.17	1.90	122.63	48	201
Union Carbide Chemicals & Plastics	Taft, LA	180.00	110.64	1.90	52.56	22	89
1990 Acrolein Emission Estimate =	**394.17**	**tons acrolein/year from production acrylic acid from acrolein**					

*Emission Factor Units = lb/ton acrolein produced

Table 3: 1990 Chloroform Emissions from Formaldehyde, Acrolein, Acetaldehyde, and Butyraldehyde Production

Facility Name	Facility Location	1990 Annual Capacity to Produce Acetaldehyde (million lbs)	1990 Annual Production of Acetaldehyde (million lbs)	Chloroform Emission Factor*	Chlororform Emissions (tons/yr)	State FIP Code	County FIP Code
Texas Eastman Co	Longview , TX	500.00	416.47	0.80	83.29	48	183
Hoechst Celanese Commodity Chemicals	Bay City, TX	250.00	208.24	0.80	41.65	48	321
1990 Chloroform Emission Estimate =	**124.94**	**tons chloroform/year from production of acetaldehyde**					

*Emission Factor Units = lb chloroform / ton acetaldehyde produced

Table 4: 1990 Chloromethane Emissions from Formaldehyde, Acrolein, Acetaldehyde, and Butyraldehyde Production

Facility Name	Facility Location	1990 Annual Capacity to Produce Acetaldehyde (million lbs)	1990 Annual Production of Acetaldehyde (million lbs)	Chloromethane Emission Factor*	Chloromethane Emissions (tons/yr)	State FIP Code	County FIP Code
Texas Eastman Co	Longview , TX	500	416.47	2.2	229.06	48	183
Hoechst Celanese Commodity Chemicals	Bay City, TX	250	208.24	2.2	114.53	48	321
1990 Chloromethane Emission Estimate	**343.59**	**tons chloromethane/year from production of actetaldehyde**					

*Emission factor units = lb chloromethane / ton acetaldehyde produced

Methodology:

The 1990 baseline emissions for the source category, Friction Products Manufacturing, were taken from information collected in 1997 and provided by Susan Zapata, U.S. EPA/ESD, to Darcy Wilson, Eastern Research Group. The information provided represented 95% of the total facilities in the U.S.

Pollutants estimated from this source category:

bis(2-ethylhexyl)phthalate
Chlorobenzene
Cresols
Ethylbenzene
Formaldehyde
Hexane
Methanol
Methyl Chloroform
Methyl Ethyl Ketone
Phenol
Tetrachloroethylene
Toluene
Trichloroethylene
Xylene

Reference:
Zapata, Susan, U.S. EPA/ESD. Personal communication to Darcy Wilson, Eastern Research Group, "Refractories and Friction Products Manufacturing," July 17, 1998.

APPENDIX A: NATIONAL ESTIMATES - Gasoline Distribution (Stage 1)

Methodology:

The following HAP emission estimates from stage I gasoline distribution have been derived from an EPA Memorandum.[1]

	Mg/yr
Benzene	5,001
Naphthalene	342
Hexane	10,471
Toluene	8,420
2,2,4-Trimethylpentane	5,236
Xylene	3,184
Ethylbenzene	684
Cumene	68
MTBE	9,194

The estimates were for a base year of 1998. The projected fuel throughput for 1998 was 446.3 billion lt. as noted in the EPA's background information document for Gasoline Distribution Industry (stage I).[2] The background document also noted that the 1990 fuel throughput was 419.698 billion lt.[2] This information was used to adjust the 1998 estimates to reflect 1990 emissions. It should also be pointed out that the estimate provided in the MACT background document was based on the assumption that 1998 usage of reformulated fuel will be approximately 45%, which is considerably higher than 1990 reformulated fuel usage. Because of this difference, the benzene and naphthalene estimates provided below represent a conservative estimate of emissions.

Benzene	5,001 Mg/yr x (419.698/446.3) = 4,702.91 Mg/yr
Naphthalene	342 Mg/yr x (419.698/446.3) = 321.61 Mg/yr
Hexane	10,471 Mg/yr x (419.698/446.3) = 9,846.87 Mg/yr
Toluene	8,420 Mg/yr x (419.698/446.3) = 7,918.12 Mg/yr
2,2,4-Trimethylpentane	5,236 Mg/yr x (419.698/446.3) = 4,923.90 Mg/yr
Xylene	3,184 Mg/yr x (419.698/446.3) = 2,994.22 Mg/yr
Ethylbenzene	684 Mg/yr x (419.698/446.3) = 643.23 Mg/yr
Cumene	68 Mg/yr x (419.698/446.3) = 63.95 Mg/yr
MTBE	9,194 Mg/yr x (419.698/446.3) = 8,645.99 Mg/yr

Conversion from Mg to tons.[3]

Benzene	4,702.91 Mg/yr = 5,184.07 tons/yr
Naphthalene	321.61 Mg/yr = 354.51 tons/yr
Hexane	9,846.87 Mg/yr = 10,855.33 tons/yr
Toluene	7,918.12 Mg/yr = 8,729.05 tons/yr
2,2,4-Trimethylpentane	4,923.90 Mg/yr = 5,428.18 tons/yr
Xylene	2,994.22 Mg/yr = 3,300.87 tons/yr
Ethylbenzene	643.23 Mg/yr = 709.11 tons/yr
Cumene	63.95 Mg/yr = 70.50 tons/yr
MTBE	8,645.99 Mg/yr = 9,531.46 tons/yr

Note that these estimates include aviation gasoline distribution.

Alkylated lead estimates were taken from the Draft Lead L&E[4].

	TEL	TML	Total
Pipelines	0.888 kg	7.29 kg	8.178 kg
Bulk Teminals	1.64 kg	13.6 kg	15.24 kg
Bulk Plants	2.18 kg	18.0 kg	20.18 kg
		Total Alkylated Lead =	43.60 kg

Conversion from Kg to ton.[3]

43.60 kg = 96.356 lbs = 0.0482 tons

MTBE = methyl-tert-butyl ether
TEL = tetraethyl lead
TML = tetramethyl lead

References

1. Memorandum from Greg LaFlam and Tracy Johnson, PES, to Stephen Shedd, EPA/OAQPS, Speciated Hazardous Air Pollutants- Baseline Emissions and Emission Reductions under the Gasoline Distribution NESHAP, 9 August 1996.

2. U.S. EPA, Gasoline Distribution Industry (Stage I)- Background Information for Proposed Standards (EPA-453/R94-002a), Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, January 1994.

3. Perry, Robert H. and Don Green, Perry's Chemical Engineer's Handbook, sixth edition, McGraw-Hill, 1984.

4. U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Lead. Draft Report. Research Triangle Park, North Carolina. February 1997.

Methodology:

Gasoline Distribution (Stage I) - EDC

Given that EDC is only used in leaded fuel, the 1990 gasoline usage from the U.S. Federal Highway Administration's *Highway Statistics* 1990 was adjusted for leaded fuel usage based on leaded fuel fraction provided by the U.S. EPA's Office of Mobile Sources.

131,583,054,000 gallons x 0.04 fraction of 1990 fuel that was leaded
= 5,263,322,160 gallons of leaded fuel

An uncontrolled emission factor from AP-42 (1985) for submerged fill tank filling was applied to the 1990 leaded fuel usage value to estimate the ethylene dichloride emissions.

5,263,322.160 (1000 gals of leaded fuel) x 9.76E-4 (lbs EDC/1000 gal)/2000 lbs/ton
= **2.57 tons of EDC**

References

E-mail from Rich Cook, U.S. EPA/OMS to Richard Billings, ERG, May 15, 1998 leaded fuel usage for 1990.

U.S. Department of Transportation/Federal Highway Administration, 1992, Highway Statistics 1990 (FHWA-PL 91-003), Washington D.C.

U.S. EPA, 1985, Compilation of Air Pollutant Emission Factors, Vol I: Stationary Point and Area Sources, Fourth Edition, AP-42. Research Triangle Park, NC.

Methodology:

Benzene

Fuel throughput for 1990 was taken from the background information document for air emission standards for gasoline distribution stage I.[1] This fuel throughput value was applied to a VOC emission factor from a typical service station as documented in the background information document for gasoline distribution stage II.[2]

419.698×10^9 l x 1,340 mg of VOC/l = 5.624×10^{14} mg = 5.624×10^8 kg of VOC

Converting kg to tons

5.624×10^8 kg of VOC = 1.240×10^9 lb of VOC = 619,939.88 tons of VOC

The VOC estimate was speciated using the speciation profile found in the background information document for gasoline distribution stage II.

Benzene 619,939.88 tons of VOC x 0.009 benzene fraction = **5,579.46 tons of benzene**

Alkylated lead

Alkylated lead estimates were taken from the Draft Lead L&E.[3]

TEL	5.77 kg
TML	46.4 kg
Total Alkylated Lead	52.17 kg

These alkylated lead values were put in terms of lead based on information in the L&E which noted that for both tetraethyl lead (TEL) and tetramethyl lead (TML), 39.39 percent of alkylated lead is elemental lead.

52.17 kg x 0.3939 = 20.55 kg

Conversion from kg to tons.

20.55 kg = 45.30 lbs = .022 tons

POM

The Polycyclic Organic Matter as 16-PAH estimate is from the 112(c)(6) Report.[4]

References

1. U.S. EPA, Gasoline Distribution Industry (Stage 1)- Background Information for Proposed Standards (EPA-453/R-94-002a), Office of Air Quality Planning and Standards, January 1994.

2. U.S. EPA, Technical Guidance- Stage II Vapor Recovery Systems for Control of Vehicle Refueling Emissions at Gasoline Dispensing Facilities Volume 1 (EPA-450/3-919-022a),Office of Air Quality Planning and Standards, November 1991.

3. U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Lead. Draft Report. Research Triangle Park, North Carolina. February 1997.

4. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Gasoline Distributions Stage II - EDC

Given that EDC is only used in leaded fuel, the 1990 gasoline usage from the U.S. Federal Highway Administration's *Highway Statistics* 1990 was adjusted for leaded fuel usage based on leaded fuel fraction provided by the U.S. EPA's Office of Mobile Sources.

131,583,054,000 gallons x 0.04 fraction of 1990 fuel that was leaded
= 5,263,322,160 gallons of leaded fuel

There were several uncontrolled emission factor from AP-42 (1985) for stage II emissions. One set of emission factors related to vapor losses due to displacement and the other set of factors related to emissions associated with spillage. The emission factors for each of the activities were averaged and summed.

Average vapor loss emission factor	0.00165 lbs/1000 gal
Average spillage emission factor	0.00011 lbs/1000 gal
Total Stage II emission factor	0.00176 lbs/1000 gal

This emission factor was applied to the 1990 leaded fuel usage value to estimate the ethylene dichloride emissions for stage II.

5,263,322.160 (1000 gals of leaded fuel) x 1.76E-3 (lbs EDC/1000 gal)/2000 lbs/ton
= **4.63 tons of EDC**

References

E-mail from Rich Cook, U.S. EPA/OMS to Richard Billings, ERG, May 15, 1998 leaded fuel usage for 1990.

U.S. Department of Transportation/Federal Highway Administration, 1992, Highway Statistics 1990 (FHWA-PL 91-003), Washington D.C.

U.S. EPA, 1985, Compilation of Air Pollutant Emission Factors, Vol I: Stationary Point and Area Sources, Fourth Edition, AP-42. Research Triangle Park, NC.

Methodology:

Mercury estimates were reported in the 112(c)(6) report.

REFERENCES

(112(c)(6) Report)
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Mercury estimates were provided in the 112(c)(6) report.

REFERENCES

(112(c)(6) Report)
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

The following HAPs are emitted from this source category:

Methyl Chloroform
Methylene Chloride
Tetrachloroethylene
Trichloroethylene

The estimate and controls information come from an EPA BID (U.S. EPA, 1993). The estimate was calculated using uncontrolled and controlled emission factors determined from individual plants. The type of controls are unknown.

The major/area percent allocation for this category is 70% major and 30% area. This allocation is based on information provided in the EPA BID (U.S. EPA, 1993) and is based on the following assumptions:

1- **All batch vapor cleaners are located at major sources**. Batch open top vapor cleaners are prevalent at metalworking and other manufacturing facilities; other batch cleaners are larger and are used for specialized cleaning. Batch cleaners account for 47% of all halogenated solvents used in degreasers.

2- **All in-line vapor cleaners are located at major sources.** They are most often found in plants where there is a constant stream of parts to be cleaned. They are usually designed for a specific workload and production rate situation. In-line cleaners (vapor as well as cold cleaning) account for 23% of all halogenated solvents used in degreasers. Most are vapor cleaners.

3- **The remaining halogenated solvent usage in degreasers occurs at area sources.** The remaining cleaners are batch cold cleaning units (excluding in-line cleaners, including carburetor cleaners) that are used for small maintenance cleaning and parts washing. Although most units do not use halogenated solvents, they still account for 30% of all halogenated solvents used in degreasers.

References

U.S. Environmental Protection Agency. National Emission Standards for Hazardous Air Pollutants: Halogenated Solvent Cleaning-Background Information Document. Office of Air Quality Planning and Standards, Research Triangle Park NC. November 1993. EPA-453/R-93-054
.

Methodology:

The chromium national emission estimates for (1) hard chromium plating; (2) decorative chromium plating; and (3) chromium anodizing are from the national baseline emission estimates that were documented on December 16, 1993 in the Federal Register for the proposed NESHAP for chromium electroplating and chromium anodizing tanks (Reference 1).

Reference:

1. National Emission Standards for Hazardous Air Pollutants; Proposed Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks. Federal Register 58. Page 65768. December 16, 1993.

Methodology:

Nationwide Chromium Emission Estimate (tons/year) (a)			
Type of Operation	Small Plant (<60 million Ah/yr)	Large Plant (>60 million Ah/yr)	TOTAL (Small and Large Plant)
	Tons Per Year	Tons Per Year	Tons Per Year
Hard Chromium Plating	20.30	139.30	159.60
Decorative Chromium Plating	0.00	11.50	11.50
Chromium Anodizing	0.00	3.90	3.90
		TOTAL:	175.00

(a) Reference:
National Emission Standards for Hazardous Air Pollutants; Proposed Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks. Federal Register 58. Page 65768. December 16, 1993.

Methodology:

Hazardous Waste Incineration

The estimates in this section reflect 1996 level emissions. Estimates are provided for the following HAPs:

Lead	Chromium
Manganese	Cobalt
Mercury	Hydrogen Chloride
Nickel	Selenium
Arsenic	Chlorine
Beryllium	Dioxin/Furans
Cadmium	

The MACT category Hazardous Waste Incineration (HWI) includes Portland cement facilities that burn hazardous waste, dedicated commercial hazardous waste incinerators, lightweight aggregate kilns that burn hazardous waste, and onsite incinerators that burn hazardous waste. Most of the estimates for these sources were provided by Frank Behan, EPA/OSW July 1998.

All of the HWI sources, including Portland cement facilities that burn hazardous waste, are included in this section of the inventory. The estimates provided by OSW reflect 1996 emissions. For portland cement facilities that burn hazardous waste, these 1996 emissions were adjusted to reflect 1990 levels based on capacity of individual facilities that were identified as burning hazardous waste during 1990. Note that between 1990 and 1996 clinker produced by Portland cement facilities that burn hazardous waste declined by 24 percent. The 1996 emission estimates were adjusted using this information to approximate 1990 emission levels. These emission levels were then summed with the estimates for dedicated commercial hazardous waste incinerators, lightweight aggregate kilns that burn hazardous waste, and onsite incinerators that burn hazardous waste to produce the national estimate.

The emission estimate for Polychlorinated Biphenyls (Aroclors), mercury, Polycyclic Organic Matter as 7-PAH and dioxin/furan were available from the 112(c)(6) report (U.S. EPA, 1998).

References

U.S. EPA/OSW, e-mail from Frank Behan, EPA/OSW, and Richard Billings, ERG, *HW Combustor Information*, 9 July 1998.

U.S. EPA/OSW, e-mail from Frank Behan, EPA/OSW, and Richard Billings, ERG, 1996 *Portland Cement Activity Data*, 15 July 1998.

U.S. EPA/OAQPS, *1990 Emissions Inventory of Section 112(c)(6) Pollutants*, Research Triangle Park, NC, April 1998.

APPENDIX A: NATIONAL ESTIMATES - Hazardous Waste Incineration

Methodology:

1996 Emission Estimates for Hazardous Waste Incinerators*

Type**	Lead (kg/yr)	Manganese (kg/yr)	Mercury (g/yr)	Nickel (kg/yr)	Arsenic (kg/yr)	Beryllium (kg/yr)
	25	26	27	30	11	13
CINC	3.89E+03	3.99E+02	1.49E+06	2.63E+02	3.13E+02	2.85E+01
LWAK	2.41E+02	1.43E+01	3.09E+04	8.35E+01	1.37E+01	1.51E+00
OINC-L	4.64E+04	6.56E+02	1.09E+06	1.22E+03	4.45E+03	9.21E+01
OINC-S	4.52E+02	2.49E+02	8.04E+04	1.05E+02	1.65E+02	2.62E+00
1996 Total	5.10E+04	1.32E+03	2.70E+06	1.67E+03	4.94E+03	1.25E+02
1996 Total tons	5.62E+01	1.45	2.97	1.84	5.45	0.14
PC HAZ. WASTE tons	4.05E+01	0.49	2.75	0.67	0.32	0.04
Total tons	**96.72**	**1.94**	**5.72**	**2.51**	**5.77**	**0.18**

* In this estimate EPA/OSW provided 1996 facility specific estimates for incinerators that burn hazardous w aste.

** CINC=commercial haz waste incinerator;LWAK=haz w aste lightw eight aggregate kiln; OINC-L=onsite incinerator - large; OINC-S=onsite incinerator - small; PC = Portland cement facilities.

1996 Emission Estimates for Hazardous Waste Incinerators*

Type**	Chromium VI (kg/yr)	Chromium III (kg/yr)	Chromium (kg/yr)	Cobalt (kg/yr)	HCl (kg/yr)	Selenium (kg/yr)
			17	106	135	173
CINC	5.50E+00	1.76E+02	1.99E+02	1.70E+02	2.82E+05	2.14E+02
LWAK	3.17E+00	8.28E+01	8.60E+01	1.07E+01	1.83E+06	3.67E+00
OINC-L	7.17E+02	1.89E+03	2.60E+03	1.09E+02	1.98E+06	9.06E+01
OINC-S	3.58E+01	1.11E+02	1.47E+02	3.86E+01	4.00E+05	1.85E+01
1996 Total	7.61E+02	2.26E+03	3.04E+03	3.28E+02	4.49E+06	3.27E+02
1996 Total tons	0.84	2.49	3.35	0.36	4.95E+03	0.36
PC HAZ. WASTE tons			0.83	0.39	4.48E+03	2.60
Total tons			**4.18**	**0.75**	**9430**	**2.96**

* In this estimate EPA/OSW provided 1996 facility specific estimates for incinerators that burn hazardous w aste.

** CINC=commercial haz waste incinerator;LWAK=haz w aste lightw eight aggregate kiln; OINC-L=onsite incinerator - large; OINC-S=onsite incinerator - small; PC = Portland cement facilities.

Methodology:

Ethylene Oxide

The number of facilities and estimate come from an EPA memorandum (U.S. EPA, 1989a).

Hospital sterilizers use catalytic oxidation to control ethylene oxide emissions (U.S. EPA, 1989b).

References

Memorandum from David Markwordt, U.S. Environmental Protection Agency, OAQPS. March 16,1989a.

U.S. Environmental Protection Agency. Alternative Control Technology Document – Ethylene Oxide Sterilization/Fumigation Operations. Office of Air Quality Planning and Standards. March 1989b. Final Report. Research Triangle Park, North Carolina. EPA-450/3-89-007.

Methodology:

Summary of Emission Estimation Method for Human Cremation

The 1990 national emission estimates for arsenic, beryllium, cadmium, chromium, formaldehyde, mercury, nickel, and POM (as 16 PAH) were developed by multiplying an emission factor by a national activity estimate. Emission factors for these hazardous air pollutants, except formaldehyde, were taken from the State of California Air Resources Board Test Report No. C-90-004 (Reference 1). The emission factor used for formaldehyde was reported in the USEPA FIRE System Database (Reference 2). Emission factors were converted to a pound per ton basis using the procedure provided by the Emission Standards Division (Reference 3). National activity was provided by the Emission Standards Division (Reference 3) based on an assumed body weight of 150 pounds and information reported by the Cremation Association of North America (Reference 4) that 366,000 bodies were cremated in 1990.

References:

1. State of California Air Resources Board, Engineering Evaluation Branch, Monitoring and Laboratory Division. "Evaluation Test on Two Propane Fired Crematories at Camellia Lawn Cemetery." Test Report No. C-90-004. October 29, 1992.

2. U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

3. Crume, Richard, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Human and Animal Cremation information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. October 30, 1998.

4. Cremation Association of North America. The Cremationist. Volume 30, Number 3, 1994.

Methodology:

Nationwide Emissions from Human Cremation, 1990

Pollutant	Emission Factor (lb/ton cremated)	Emission Factor Reference	National Activity Level (Reference 1, 2) (tons cremated/year)	National Emissions (tons/year)
arsenic	4.00E-04	Reference 2, 3	2.75E+04	5.50E-03
beryllium	1.84E-05	Reference 2, 3	2.75E+04	2.53E-04
cadmium	1.48E-04	Reference 2, 3	2.75E+04	2.03E-03
chromium	3.99E-04	Reference 2, 3	2.75E+04	5.48E-03
formaldehyde	2.89E-09	Reference 2, 4	2.75E+04	3.98E-08
mercury	4.39E-02	Reference 2, 3	2.75E+04	6.03E-01
nickel	5.09E-04	Reference 2, 3	2.75E+04	7.00E-03
POM as 16-PAH	9.63E-04	Reference 2, 3	2.75E+04	1.32E-02

References:

1. Cremation Association of North America. *The Cremationist*. Volume 30, Number 3, 1994.
2. Crume, Richard, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Human and Animal Cremation information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. October 30, 1998.
3. State of California Air Resources Board, Engineering Evaluation Branch, Monitoring and Laboratory Division. "Evaluation Test on Two Propane Fired Crematories at Camellia Lawn Cemetery." Test Report No. C-90-004. October 29, 1992.
4. U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

Subcategory - Industrial Boilers: Anthracite Coal Combustion

Methodology:

The activity level for industrial anthracite coal combustion comes from the 112(c)(6) report {US EPA, 1997} and from data supplied by the Emission Standards Division {Porter, 1998}based on information from the Energy Information Administration {EIA, 1992}. The heating value conversion is from AP-42 {US EPA, 1996}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. All emission factors provided by ESD apply to all types of coal combustion. These emission factors are from 10 facilities firing bituminous, 8 facilities firing subbituminous, and 1 facility firing lignite. Factors apply to boilers utilizing both wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator or fabric filter:

Acetaldehyde	Chlorobenzene	Isophorone	Phenol
Acetophenone	Ethylbenzene	Methyl Bromide	Propionaldehyde
Acrolein	Ethylene Dichloride	Methyl Chloride	Styrene
Benzene	Formaldehyde	Methyl Ethyl Ketone	Tetrachloroethylene
Bis(2-ethylhexyl) Phthalate	Hexane	Methylene Chloride	Toluene
Carbon Disulfide			

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. These emission factors are from 11 facilities firing bituminous, 15 facilities firing subbituminous, and 2 facilities firing lignite. Factors apply to boilers utilizing either venturi scrubbers, spray dryer absorbers, or wet limestone scrubbers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator, fabric filter, or venturi scrubber:

Antimony	Beryllium	Chromium	Lead	Mercury	Selenium
Arsenic	Cadmium	Cobalt	Manganese	Nickel	

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for hydrogen chloride and hydrogen fluoride. The Emission Standards Division {Porter, 1998} supplied emission factors for dioxins/furans (as toxic equivalency units) and POM as 16 PAH.

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 230, 1992.

4. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Industrial Boilers for Anthracite Coal Combustion, 1991

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	Nat'l Activity Level (Ref. 1, 2, 3) (tons coal burned/yr)	Nat'l Emissions (tons/yr)
acetaldehyde	5.7E-04	Reference 2, 3	1.29E+05	3.69E-02
acetophenone	1.5E-05	Reference 2, 3	1.29E+05	9.70E-04
acrolein	2.9E-04	Reference 2, 3	1.29E+05	1.88E-02
benzene	1.3E-03	Reference 2, 3	1.29E+05	8.41E-02
bis(2-ethylhexyl)phthalate	7.3E-05	Reference 2, 3	1.29E+05	4.72E-03
carbon disulfide	1.3E-04	Reference 2, 3	1.29E+05	8.41E-03
chlorobenzene	2.2E-05	Reference 2, 3	1.29E+05	1.42E-03
dioxins/furans (TEQ units)	3.5E-12	Reference 2	1.29E+05	2.26E-10
ethylbenzene	9.4E-05	Reference 2, 3	1.29E+05	6.08E-03
ethylene dichloride	4.0E-05	Reference 2, 3	1.29E+05	2.59E-03
formaldehyde	2.4E-04	Reference 2, 3	1.29E+05	1.55E-02
hexane	6.7E-05	Reference 2, 3	1.29E+05	4.33E-03
hydrogen chloride	1.2E+00	Reference 2, 3	1.29E+05	7.76E+01
hydrogen fluoride	1.5E-01	Reference 2, 3	1.29E+05	9.70E+00
isophorone	5.8E-04	Reference 2, 3	1.29E+05	3.75E-02
methyl bromide	1.6E-04	Reference 2, 3	1.29E+05	1.03E-02
methyl chloride	5.3E-04	Reference 2, 3	1.29E+05	3.43E-02
methyl ethyl ketone	3.9E-04	Reference 2, 3	1.29E+05	2.52E-02
methylene chloride	2.9E-04	Reference 2, 3	1.29E+05	1.88E-02
phenol	1.6E-05	Reference 2, 3	1.29E+05	1.03E-03
POM as 16-PAH	1.9E-05	Reference 2	1.29E+05	1.23E-03
propionaldehyde	3.8E-04	Reference 2, 3	1.29E+05	2.46E-02
styrene	2.5E-05	Reference 2, 3	1.29E+05	1.62E-03
tetrachloroethylene	4.3E-05	Reference 2, 3	1.29E+05	2.78E-03
toluene	2.4E-04	Reference 2, 3	1.29E+05	1.55E-02

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in Btu for all coal into tons of anthracite coal:				
Activity level, btu =	859	trillion Btu/yr	all industrial coal use	
		Bituminous and lignite, all coal use =	2.58E+09	MMBtu/yr
		Anthracite, all coal use =	9594000	MMBtu/yr
		Fraction anthracite =		3.70E-03
		Activity level, anthracite, btu =	3.18E+00	trillion btu/yr
		Heating value, anthracite =	12300	btu/lb
		trillion btu =	1.00E+12	btu
		ton =	2000	lb
Activity level, anthracite, tons =		1.29E+05	tons/yr	

Methodology:

Nationwide Emissions from Industrial Boilers for Anthracite Coal Combustion, 1991

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1, 2, 3) (tons coal burned/year)	National Emissions (tons/year)
antimony	1.8E-05	Reference 2, 3	1.29E+05	1.16E-03
arsenic	4.1E-04	Reference 2, 3	1.29E+05	2.65E-02
beryllium	2.1E-05	Reference 2, 3	1.29E+05	1.36E-03
cadmium	5.1E-05	Reference 2, 3	1.29E+05	3.30E-03
chromium	2.6E-04	Reference 2, 3	1.29E+05	1.68E-02
cobalt	1.0E-04	Reference 2, 3	1.29E+05	6.47E-03
lead	4.2E-04	Reference 2, 3	1.29E+05	2.72E-02
manganese	4.9E-04	Reference 2, 3	1.29E+05	3.17E-02
mercury	8.3E-05	Reference 2, 3	1.29E+05	5.37E-03
nickel	2.8E-04	Reference 2, 3	1.29E+05	1.81E-02
selenium	1.3E-03	Reference 2, 3	1.29E+05	8.41E-02

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in Btu for all coal into tons of anthracite coal:

Activity level, btu =	859	trillion Btu/yr	all industrial coal use	
	Bituminous and lignite, all coal use =		2.58E+09	MMBtu/yr
	Anthracite, all coal use =		9594000	MMBtu/yr
		Fraction anthracite =		3.70E-03
	Activity level, anthracite, btu =		3.18E+00	trillion btu/yr
	Heating value, anthracite =		12300	btu/lb
		trillion btu =	1.00E+12	btu
		ton =	2000	lb
Activity level, anthracite, tons =		1.29E+05	tons/yr	

Methodology:

The activity level for industrial bituminous and lignite coal combustion comes from the 112(c)(6) report {US EPA, 1997} and from data supplied by the Emission Standards Division {Porter, 1998} based on information from the Energy Information Administration {EIA, 1992}. The heating value conversion is from EIA {EIA, 1992}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. These emission factors are from 10 facilities firing bituminous, 8 facilities firing subbituminous, and 1 facility firing lignite. Factors apply to boilers utilizing both wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator or fabric filter:

Acetaldehyde	Chlorobenzene	Isophorone	Phenol
Acetophenone	Ethylbenzene	Methyl Bromide	Propionaldehyde
Acrolein	Ethylene Dichloride	Methyl Chloride	Styrene
Benzene	Formaldehyde	Methyl Ethyl Ketone	Tetrachloroethylene
Bis(2-ethylhexyl) Phthalate	Hexane	Methylene Chloride	Toluene
Carbon Disulfide			

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. These emission factors are from 11 facilities firing bituminous, 15 facilities firing subbituminous, and 2 facilities firing lignite. Factors apply to boilers utilizing either venturi scrubbers, spray dryer absorbers, or wet limestone scrubbers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator, fabric filter, or venturi scrubber:

Antimony	Beryllium	Chromium	Lead	Mercury	Selenium
Arsenic	Cadmium	Cobalt	Manganese	Nickel	

The Emission Standards Division {Porter, 1998} supplied emission factors for hydrogen chloride and hydrogen fluoride based on AP-42 {US EPA, 1996}. The Emission Standards Division {Porter, 1998} supplied emission factors for dioxins/furans (as toxic equivalency units) and POM as 16 PAH.

<u>References</u>:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 230, 1992.

4. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 39-344, 1992.

5. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Industrial Boilers for Bituminous and Lignite Coal Combustion, 1991

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1, 2, 3) (tons coal burned/year)	National Emissions (tons/year)
acetaldehyde	5.7E-04	Reference 2, 4	3.81E+07	1.09E+01
acetophenone	1.5E-05	Reference 2, 4	3.81E+07	2.86E-01
acrolein	2.9E-04	Reference 2, 4	3.81E+07	5.53E+00
benzene	1.3E-03	Reference 2, 4	3.81E+07	2.48E+01
bis(2-ethylhexyl)phthalate	7.3E-05	Reference 2, 4	3.81E+07	1.39E+00
carbon disulfide	1.3E-04	Reference 2, 4	3.81E+07	2.48E+00
chlorobenzene	2.2E-05	Reference 2, 4	3.81E+07	4.19E-01
dioxins/furans (TEQ units)	3.5E-12	Reference 2, 4	3.81E+07	6.67E-08
ethylbenzene	9.4E-05	Reference 2, 4	3.81E+07	1.79E+00
ethylene dichloride	4.0E-05	Reference 2, 4	3.81E+07	7.63E-01
formaldehyde	2.4E-04	Reference 2, 4	3.81E+07	4.58E+00
hexane	6.7E-05	Reference 2, 4	3.81E+07	1.28E+00
hydrogen chloride	1.2E+00	Reference 2, 4	3.81E+07	2.29E+04
hydrogen fluoride	1.5E-01	Reference 2, 4	3.81E+07	2.86E+03
isophorone	5.8E-04	Reference 2, 4	3.81E+07	1.11E+01
methyl bromide	1.6E-04	Reference 2, 4	3.81E+07	3.05E+00
methyl chloride	5.3E-04	Reference 2, 4	3.81E+07	1.01E+01
methyl ethyl ketone	3.9E-04	Reference 2, 4	3.81E+07	7.44E+00
methylene chloride	2.9E-04	Reference 2, 4	3.81E+07	5.53E+00
phenol	1.6E-05	Reference 2, 4	3.81E+07	3.05E-01
POM as 16-PAH	1.9E-05	Reference 2	3.81E+07	3.62E-01
propionaldehyde	3.8E-04	Reference 2, 4	3.81E+07	7.24E+00
styrene	2.5E-05	Reference 2, 4	3.81E+07	4.77E-01
tetrachloroethylene	4.3E-05	Reference 2, 4	3.81E+07	8.20E-01
toluene	2.4E-04	Reference 2, 4	3.81E+07	4.58E+00

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 39-344, 1992.
4. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in Btu for all coal into tons of bituminous and lignite coal:

Activity level, btu =	859	trillion Btu/yr	all industrial coal use		
	Bituminous and lignite, all coal use =		2.58E+09	MMBtu/yr	
	Anthracite, all coal use =		9594000	MMBtu/yr	
		Fraction bituminous and lignite =		9.96E-01	
Activity level, bituminous and lignite, btu =			8.56E+02	trillion btu/yr	
	Heating value, bituminous and lignite =		11222	btu/lb	
trillion btu =	1.00E+12	btu	ton =	2000	lb
Activity level, bituminous and lignite, tons =		3.81E+07	tons/yr		

Methodology:

Nationwide Emissions from Industrial Boilers for Bituminous and Lignite Coal Combustion, 1991

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1, 2, 3) (tons coal burned/year)	National Emissions (tons/year)
antimony	1.8E-05	Reference 2, 4	3.81E+07	3.43E-01
arsenic	4.1E-04	Reference 2, 4	3.81E+07	7.82E+00
beryllium	2.1E-05	Reference 2, 4	3.81E+07	4.00E-01
cadmium	5.1E-05	Reference 2, 4	3.81E+07	9.72E-01
chromium	2.6E-04	Reference 2, 4	3.81E+07	4.96E+00
cobalt	1.0E-04	Reference 2, 4	3.81E+07	1.91E+00
lead	4.2E-04	Reference 2, 4	3.81E+07	8.01E+00
manganese	4.9E-04	Reference 2, 4	3.81E+07	9.34E+00
mercury	8.3E-05	Reference 2, 4	3.81E+07	1.58E+00
nickel	2.8E-04	Reference 2, 4	3.81E+07	5.34E+00
selenium	1.3E-03	Reference 2, 4	3.81E+07	2.48E+01

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 39-344, 1992.
4. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina.

Conversion of Activity level in Btu for all coal into tons of bituminous and lignite coal:

Activity level, btu =	859	trillion Btu/yr	all industrial coal use	
	Bituminous and lignite, all coal use =		2.58E+09	MMBtu/yr
	Anthracite, all coal use =		9594000	MMBtu/yr
		Fraction bituminous and lignite =		9.96E-01
Activity level, bituminous and lignite, btu =			8.56E+02	trillion btu/yr
Heating value, bituminous and lignite =			11222	btu/lb
		trillion btu =	1.00E+12	btu
		ton =	2000	lb
Activity level, bituminous and lignite, tons =		3.81E+07	tons/yr	

Subcategory - Industrial Boilers: Distillate Oil Combustion

Methodology:

The activity level for industrial distillate combustion comes from data supplied by the Emission Standards Division {Porter, 1998} based on information from the Energy Infomation Administration {EIA, 1992}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1998} for benzene, formaldehyde, and POM as 16-PAH. Data are for residual oil fired boilers. POM as 16-PAH was calculated by summing the emission factors for fifteen PAH (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b,k) fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene). The formaldehyde emission factor is based only on data from utilities using No. 6 oil. The higher heating value for distillate oil comes from the Emission Standards Division {Porter, 1998}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1998} for arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, and selenium. Data are for residual oil fired boilers. Eighteen out of 19 sources were uncontrolled and 1 source was controlled with a low efficiency electrostatic precipitator.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

<u>References</u>:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. p 230, 1992.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Industrial Boilers for Distillate Oil Combustion, 1991

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu oil burned/year)	National Emissions (tons/year)
acetaldehyde	3.5E-05	Reference 1	4.00E+07	7.00E-01
benzene	1.5E-06	Reference 1, 3	4.00E+07	3.00E-02
formaldehyde	2.4E-04	Reference 1, 3	4.00E+07	4.80E+00
POM as 16-PAH	8.4E-06	Reference 1, 3	4.00E+07	1.68E-01

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
2. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Markets and End Use, U.S. Department of Energy, Washington, D.C. p 230, 1992.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in trillion Btu to MM Btu

Activity level, btu =	40	trillion Btu/yr		
		trillion btu =	1.00E+06	MM Btu
Activity level, MM Btu =		4.00E+07	MM Btu/yr	

Conversion of Emission Factor in lb/thousand gal to lb/MM Btu

	lb/thousand gal	lb/MM Btu	MM Btu/thousand gal
Benzene	2.14E-04	1.5E-06	140
Formaldehyde	3.30E-02	2.4E-04	140
POM as 16 PAH	1.19E-03	8.5E-06	140
Acenaphthene	2.11E-05		
Acenapthylene	2.53E-07		
Anthracene	1.22E-06		
Benz(a)anthracene	4.01E-06		
Benzo(b,k)fluoranthen	1.48E-06		
Benzo(g,h,i)perylene	2.26E-06		
Chrysene	2.38E-06		
Dibenzo(a,h)anthracen	1.67E-06		
Fluoranthene	4.84E-06		
Fluorene	4.47E-06		
Indeno(1,2,3-c,d)pyren	2.14E-06		
Naphthalene	1.13E-03		
Phenanthrene	1.05E-05		
Pyrene	4.25E-06		

Methodology:

Nationwide Emissions from Industrial Boilers for Distillate Oil Combustion, 1991

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu oil burned/year)	National Emissions (tons/year)
arsenic	4.0E-06	Reference 1, 3	4.00E+07	8.00E-02
beryllium	3.0E-06	Reference 1, 3	4.00E+07	6.00E-02
cadmium	3.0E-06	Reference 1, 3	4.00E+07	6.00E-02
chromium	3.0E-06	Reference 1, 3	4.00E+07	6.00E-02
lead	9.0E-06	Reference 1, 3	4.00E+07	1.80E-01
manganese	6.0E-06	Reference 1, 3	4.00E+07	1.20E-01
mercury	3.0E-06	Reference 1, 3	4.00E+07	6.00E-02
nickel	3.0E-06	Reference 1, 3	4.00E+07	6.00E-02
selenium	1.5E-05	Reference 1, 3	4.00E+07	3.00E-01

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
2. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Markets and End Use, U.S. Department of Energy, Washington, D.C. p 230, 1992.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in trillion Btu to MM Btu

Activity level, btu =	40	trillion Btu/yr		
		trillion btu =	1.00E+06	MM Btu
Activity level, MM Btu =		4.00E+07	MM Btu/yr	

Conversion of Emission Factor in lb/trillion Btu to lb/MM Btu

	lb/trillion Btu	lb/MM Btu	MM Btu/trillion Btu
Arsenic	4.00E+00	4.0E-06	1.00E+06
Beryllium	3.00E+00	3.0E-06	1.00E+06
Cadmium	3.00E+00	3.0E-06	1.00E+06
Chromium	3.00E+00	3.0E-06	1.00E+06
Lead	9.00E+00	9.0E-06	1.00E+06
Manganese	6.00E+00	6.0E-06	1.00E+06
Mercury	3.00E+00	3.0E-06	1.00E+06
Nickel	3.00E+00	3.0E-06	1.00E+06
Selenium	1.50E+01	1.5E-05	1.00E+06

Methodology:

The activity level for industrial natural gas combustion comes from data supplied by the Emission Standards Division {Porter, 1998} based on information from the Energy Information Administration {EIA, 1992}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1998} for benzene, formaldehyde, and POM as 16-PAH. Data are for all natural gas combustion sources. POM as 16-PAH was calculated by summing the emission factors for the five PAH (fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene) which had emission factors reported above the method detection limit. The higher heating value for natural gas was supplied by the emissions standards division {Porter, 1998}.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. p 230, 1992.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Industrial Boilers for Natural Gas Combustion, 1991

Pollutant	Emission Factor (lb/MM Btu NG)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu NG burned/year)	National Emissions (tons/year)
acetaldehyde	1.3E-08	Reference 1	2.10E+09	1.36E-02
benzene	2.1E-06	Reference 1, 3	2.10E+09	2.20E+00
formaldehyde	7.5E-05	Reference 1, 3	2.10E+09	7.87E+01
POM as 16-PAH	6.4E-07	Reference 1, 3	2.10E+09	6.71E-01

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
2. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. p 230, 1992.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in trillion Btu to MM Btu

Activity level, btu =	2098	trillion Btu/yr		
		trillion btu =	1.00E+06	MM Btu
Activity level, MM Btu =		2.10E+09	MM Btu/yr	

Conversion of Emission Factor in lb/million scf to lb/MM Btu

	lb/million scf	lb/MM Btu	MM Btu/million scf
Benzene	2.10E-03	2.1E-06	1000
Formaldehyde	7.50E-02	7.5E-05	1000
POM as 16 PAH	6.38E-04	6.4E-07	1000

Acenaphthene	<0.0000018
Acenapthylene	<0.0000018
Anthracene	<0.0000024
Benz(a)anthracene	<0.0000018
Benzo(a)pyrene	<0.0000012
Benzo(b)fluoranthene	<0.0000018
Benzo(g,h,i)perylene	<0.0000012
Benzo(k)fluoranthene	<0.0000018
Chrysene	<0.0000018
Dibenzo(a,h)anthracen	<0.0000012
Fluoranthene	3.00E-06
Fluorene	2.80E-06
Indeno(1,2,3-c,d)pyren	<0.0000018
Naphthalene	6.10E-04
Phenanthrene	1.70E-05
Pyrene	5.00E-06

Methodology:

The activity level for industrial residual oil combustion comes from data supplied by the Emission Standards Division {Porter, 1998} based on information from the Energy Information Administration {EIA, 1992}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1998} for benzene, formaldehyde, and POM as 16-PAH. Data are for residual oil fired boilers. POM as 16-PAH was calculated by summing the emission factors for fifteen PAH (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b,k) fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene). The formaldehyde emission factor is based only on data from utilities using No. 6 oil. The higher heating value for residual oil was supplied by the Emissions Standards Division {Porter, 1998}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1998} for arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, and selenium. Data are for residual oil fired boilers. Eighteen out of 19 sources were uncontrolled and 1 source was controlled with a low efficiency electrostatic precipitator.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. p 230, 1992.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1998.

Subcategory - Industrial Boilers: Residual Oil Combustion

Methodology:

Nationwide Emissions from Industrial Boilers for Residual Oil Combustion, 1991

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu oil burned/year)	National Emissions (tons/year)
acetaldehyde	3.5E-05	Reference 1	2.96E+08	5.18E+00
benzene	1.5E-06	Reference 1, 3	2.96E+08	2.22E-01
formaldehyde	2.4E-04	Reference 1, 3	2.96E+08	3.55E+01
POM as 16-PAH	8.4E-06	Reference 1, 3	2.96E+08	1.24E+00

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. p 230, 1992.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1998.

Conversion of Activity level in trillion Btu to MM Btu

Activity level, btu =	296	trillion Btu/yr		
		trillion btu =	1.00E+06	MM Btu
Activity level, MM Btu =		2.96E+08	MM Btu/yr	

Conversion of Emission Factor in lb/thousand gal to lb/MM Btu

	lb/thousand gal	lb/MM Btu	MM Btu/thousand gal
Benzene	2.14E-04	1.5E-06	140
Formaldehyde	3.30E-02	2.4E-04	140
POM as 16 PAH	1.19E-03	8.5E-06	140
Acenaphthene	2.11E-05		
Acenapthylene	2.53E-07		
Anthracene	1.22E-06		
Benz(a)anthracene	4.01E-06		
Benzo(b,k)fluoranthene	1.48E-06		
Benzo(g,h,i)perylene	2.26E-06		
Chrysene	2.38E-06		
Dibenzo(a,h)anthracene	1.67E-06		
Fluoranthene	4.84E-06		
Fluorene	4.47E-06		
Indeno(1,2,3-c,d)pyrene	2.14E-06		
Naphthalene	1.13E-03		
Phenanthrene	1.05E-05		
Pyrene	4.25E-06		

Subcategory - Industrial Boilers: Residual Oil Combustion

Methodology:

Nationwide Emissions from Industrial Boilers for Residual Oil Combustion, 1991

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu oil burned/year)	National Emissions (tons/year)
arsenic	9.4E-06	Reference 1, 3	2.96E+08	1.39E+00
beryllium	2.0E-07	Reference 1, 3	2.96E+08	2.96E-02
cadmium	2.8E-06	Reference 1, 3	2.96E+08	4.14E-01
chromium	6.0E-06	Reference 1, 3	2.96E+08	8.88E-01
lead	1.1E-05	Reference 1, 3	2.96E+08	1.63E+00
manganese	2.1E-05	Reference 1, 3	2.96E+08	3.11E+00
mercury	8.1E-07	Reference 1, 3	2.96E+08	1.20E-01
nickel	6.0E-04	Reference 1, 3	2.96E+08	8.88E+01
selenium	4.9E-06	Reference 1, 3	2.96E+08	7.25E-01

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. Energy Information Administration (EIA). Manufacturing Consumption of Energy 1991. Office of Markets and End Use, U.S. Department of Energy, Washington, D.C. p 230, 1992.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1998.

Conversion of Activity level in trillion Btu to MM Btu

Activity level, btu =	296	trillion Btu/yr		
		trillion btu =	1.00E+06	MM Btu
Activity level, MM Btu =		2.96E+08	MM Btu/yr	

Conversion of Emission Factor in lb/thousand gal to lb/MM Btu

	lb/thousand gal	lb/MM Btu	MM Btu/thousand gal
Arsenic	1.32E-03	9.4E-06	140
Beryllium	2.78E-05	2.0E-07	140
Cadmium	3.98E-04	2.8E-06	140
Chromium	8.45E-04	6.0E-06	140
Lead	1.51E-03	1.1E-05	140
Manganese	3.00E-03	2.1E-05	140
Mercury	1.13E-04	8.1E-07	140
Nickel	8.45E-02	6.0E-04	140
Selenium	6.83E-04	4.9E-06	140

Methodology:

The activity level for industrial waste oil combustion comes from the 112(c)(6) report {EPA, 1997}. The higher heating value comes from the emission standards division {Porter, 1998}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for benzene, formaldehyde, and POM as 16-PAH. Data are for residual oil fired boilers. POM as 16-PAH was calculated by summing the emission factors for fifteen PAH (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b,k) fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluroanthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene). The formaldehyde emission factor is based only on data from utilities using No. 6 oil.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, and selenium. Data are for distillate oil fired boilers.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

<u>References</u>:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Industrial Boilers for Waste Oil Combustion, 1993

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu oil burned/year)	National Emissions (tons/year)
acetaldehyde	3.5E-05	Reference 2	8.26E+07	1.45E+00
benzene	1.5E-06	Reference 2, 3	8.26E+07	6.20E-02
formaldehyde	2.4E-04	Reference 2, 3	8.26E+07	9.91E+00
POM as 16-PAH	8.4E-06	Reference 2, 3	8.26E+07	3.47E-01

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in gal/yr to MM Btu/yr

Activity level, gal/yr =	5.90E+08	gal/yr		
	higher heating value =		1.40E-01	MM Btu/gal
Activity level, MM Btu =		8.26E+07	MM Btu/yr	

Conversion of Emission Factor in lb/thousand gal to lb/MM Btu

	lb/thousand gal	lb/MM Btu	MM Btu/thousand gal
Benzene	2.14E-04	1.5E-06	140
Formaldehyde	3.30E-02	2.4E-04	140
POM as 16 PAH	1.19E-03	8.5E-06	140
Acenaphthene	2.11E-05		
Acenapthylene	2.53E-07		
Anthracene	1.22E-06		
Benz(a)anthracene	4.01E-06		
Benzo(b,k)fluoranthene	1.48E-06		
Benzo(g,h,i)perylene	2.26E-06		
Chrysene	2.38E-06		
Dibenzo(a,h)anthracene	1.67E-06		
Fluoranthene	4.84E-06		
Fluorene	4.47E-06		
Indeno(1,2,3-c,d)pyrene	2.14E-06		
Naphthalene	1.13E-03		
Phenanthrene	1.05E-05		
Pyrene	4.25E-06		

Methodology:

Nationwide Emissions from Industrial Boilers for Waste Oil Combustion, 1993

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu oil burned/year)	National Emissions (tons/year)
arsenic	4.0E-06	Reference 2, 3	8.26E+07	1.65E-01
beryllium	3.0E-06	Reference 2, 3	8.26E+07	1.24E-01
cadmium	3.0E-06	Reference 2, 3	8.26E+07	1.24E-01
chromium	3.0E-06	Reference 2, 3	8.26E+07	1.24E-01
lead	9.0E-06	Reference 2, 3	8.26E+07	3.72E-01
manganese	6.0E-06	Reference 2, 3	8.26E+07	2.48E-01
mercury	3.0E-06	Reference 2, 3	8.26E+07	1.24E-01
nickel	3.0E-06	Reference 2, 3	8.26E+07	1.24E-01
selenium	1.5E-05	Reference 2, 3	8.26E+07	6.20E-01

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1998.

Conversion of Activity level in gal/yr to MM Btu/yr

Activity level, gal/yr =	5.90E+08	gal/yr		
	higher heating value =		1.40E-01	MM Btu/gal
Activity level, MM Btu =		8.26E+07	MM Btu/yr	

Conversion of Emission Factor in lb/trillion Btu to lb/MM Btu

	lb/trillion Btu	lb/MM Btu	MM Btu/trillion Btu
Arsenic	4.00E+00	4.0E-06	1.00E+06
Beryllium	3.00E+00	3.0E-06	1.00E+06
Cadmium	3.00E+00	3.0E-06	1.00E+06
Chromium	3.00E+00	3.0E-06	1.00E+06
Lead	9.00E+00	9.0E-06	1.00E+06
Manganese	6.00E+00	6.0E-06	1.00E+06
Mercury	3.00E+00	3.0E-06	1.00E+06
Nickel	3.00E+00	3.0E-06	1.00E+06
Selenium	1.50E+01	1.5E-05	1.00E+06

Methodology:

The HAP estimates on the next page for industrial wood/wood waste combustion emissions will be developed by multiplying activity by the appropriate emission factor.

Activity for the industrial wood/wood waste combustion estimate was derived from information received by the American Forest and Paper Association (1996) and the Energy Information Administration (1991).

Emission factors for formaldehyde, hydrogen chloride, arsenic, cadmium, chromium, lead, mercury, and manganese were supplied by the Emissions Standards Division {Porter, 1998} based on information in the AP-42 database {EPA, 1996}. The conversion factor of 4500 Btu/lb fuel burned is also taken directly from the AP-42 database (1996). All emission factors were taken from uncontrolled combustors.

The Emission Standards Division {Porter, 1998} also supplied emission factors for POM as 16 PAH, dioxin/furan in toxic equivalency units, and nickel.

Emission factors for Polycyclic Organic Matter as 7-PAH and EOM were taken from the Section 112(c)(6) report {U.S. EPA, 1997}.

References

Energy Information Administration. Estimates of U.S. Biofuels Consumption 1990, DOE/EIA-0548(90), October 1991.

American Forest and Paper Association. 1996 Statistics Data Through 1995, Paper, Paperboard, and Wood Pulp. Washington D.C. 1996.

Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Activity:	1562	trillion Btu from industrial sector				
	-1232	trillion Btu from pulp and paper industry				
	330	**trillion Btu**	from non-pulp and paper industry (dry fuel)			
	+					
	378	**trillion Btu**	from pulp and paper consumption of hogged fuel and bark (50 % moisture)			
	708	**trillion Btu**				
All HAPs except 7-PAH and EOM						
	Emission factors are given in terms of lb pollutant per ton of fuel					
	with a 50% moisture content, thus activity will be converted to this unit.					
	708e12Btu X 1 lb 50 % moisture wood fuel/4500 Btu =			1.57E+11	lb 50 % moisture wood fuel	
			=	7.87E+07	tons 50 % moisture wood fuel	
					Estimate	**Estimate**
Pollutant Name				**Factor (lb/ton)**	**(tons/yr)**	**(lb./yr)**
Arsenic & Compounds (inorganic including Arsine)				8.50E-05	3.34E+00	6.69E+03
Cadmium and Compounds				2.10E-05	8.26E-01	1.65E+03
Chromium and Compounds				1.60E-04	6.29E+00	1.26E+04
Dioxins/Furans (as TEQ units)				2.50E-09	9.83E-05	1.97E-01
Formaldehyde				8.20E-03	3.23E+02	6.45E+05
Hydrogen Chloride				7.80E-03	3.07E+02	6.14E+05
Lead and Compounds				4.50E-04	1.77E+01	3.54E+04
Manganese and Compounds				1.30E-02	5.11E+02	1.02E+06
Mercury and Compounds				5.20E-06	2.05E-01	4.09E+02
Nickel and Compounds				2.10E-05	8.26E-01	1.65E+03
POM as 16 PAH				3.50E-03	1.38E+02	2.75E+05
Sample calculation:						
0.000085 lb. Arsenic				7.87 e+7 tons of wood/wood waste		1 ton Arsenic
ton of wood/wood waste burned with 50 % moisture					with 50% moisture	2000 lb. Arsenic
7-PAH and EOM ONLY						
	The emission factors are given in terms of lb. pollutant / ton of dry wood burned					
	thus the activity must be converted to tons of dry wood.					
	708 trillion Btu X 1 lb dry wood / 8650 Btu =			8.18E+10	lb dry wood/wood waste	
				4.09E+07	tons dry wood/wood waste	
					Estimate	**Estimate**
Pollutant Name				**Factor (lb/ton)**	**(tons/yr)**	**(lb./yr)**
7-PAH				5.90E-05	1.21E+00	2.41E+03
EOM				2.16E+00	4.42E+04	8.84E+07

Methodology:

The chromium estimate of 25 tons/year for industrial process cooling towers was provided by ESD[1].

Reference

1. Telecom from Phil Mulrine, EPA-ESD to Bridget Kosmicki, ERG Confirmed 7-30-97.

Methodology:

Approach:

The 1990 estimate of emissions of cadmium compounds from manufacturing of inorganic pigments is taken from the document "Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds" (U.S. EPA, 1995). Table 4-8 in the L&E document identifies each manufacturer reporting cadmium emissions in the 1990 Toxic Chemicals Release Inventory (TRIS). Spatial allocation of the estimates was based on location of the facilities identified in the L & E document.

Cadmium Emissions Estimate

3421 lbs cadmium emissions 1990 x (1 ton / 2000 lb) = 1.7105 tons cadmium compounds emitted in 1990 from the manufacturing of inorganic pigments.

Other HAPs

The remaining HAP estimates for Inorganic Pigments Manufacturing were taken from the TRI database (U.S. EPA, 1997) based on the following SIC Code: 2816 (Inorganic Pigments).

References:

U.S. Environmental Protection Agency. Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds. Section 4.2. From the: Air CHIEF CD-ROM, Version 4.0. EPA 454/C-95-001. Research Triangle Park, North Carolina. July 1995.

U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

Facility Name	Facility Location	Cadmium Emissions (lb/yr)	Cadmium Emissions (ton/yr)	State FIP Code	County FIP Code
CP Chemicals	Sumter, SC	500	0.25	48	085
Drakenfeld Colors	Washington, PA	323	0.1615	42	125
Ferro Corp	Cleveland,OH	348	0.174	39	035
Ferro Corp	Pittsburgh, PA	260	0.13	42	003
Engelhard Corp	Louisville, KY	1315	0.6575	21	111
Johnson Matthey Inc	West Chester, PA	500	0.25	42	029
SCM Glidco Organics C	Baltimore, MD	175	0.0875	24	510
1990 Annual Emission Estimate =			1.7105	tons cadmium compound	

Estimate: 3421 lbs cadmium emissions 1990 x (1 ton / 2000 lb) = 1.7105 tons cadmium compounds emitted in 1990 from the manufacturing of inorganic pigments.

Methodology:

Approach:
1990 estimate of emissions from blending of cadmium pigments in plastics are from the document "Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds". Table 5-5 in the L&E document identifies each manufacturer reporting cadmium emissions in the 1990 Toxic Chemicals Release Inventory (TRIS). Spatial allocation of the estimates was based on location of the facilities identified in the L & E document.

Estimate:
4320 lbs cadmium emissions 1990 x (1 ton / 2000 lb) = 2.16 tons cadmium compounds emitted in 1990 from the manufacturing of cadmium pigments in plastics.

References:
U.S. Environmental Protection Agency. Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds. Section 5.4. From the: Air CHIEF CD-ROM, Version 4.0. EPA-454/C-95-001. Research Triangle Park, North Carolina. July 1995.

Methodology:

Facility Name	Facility Location	Cadmium Emissions (lb/yr)	Cadmium Emissions (ton/yr)	State FIP Code	County FIP Code
Plastics Color Chip	Ashboro, NC	500	0.25	37	151
Plastics Color Chip	Calumet City, IL	255	0.1275	17	031
Vista Chemical Co	Jeffersontown, KY	255	0.1275	21	111
Reed Plastics Corp	Albion, MI	5	0.0025	26	025
Reed Plastics Corp	Holden, MA	5	0.0025	25	027
General Color and Chemical Co	Minerva, OH	250	0.125	39	151
A. Schilman Inc	Akron, OH	10	0.005	39	153
PMS Consolidated	Norwalk, OH	500	0.25	39	077
PMS Consolidated	Ft. Worth, TX	255	0.1275	48	439
PMS Consolidated	Florence, KY	255	0.1275	21	015
PMS Consolidated	Gastonia, NC	500	0.25	37	071
PMS Consolidated	St. Peters, MO	500	0.25	29	183
PMS Consolidated	Somerset, NJ	255	0.1275	34	035
PMS Consolidated	Elk Grove Village, IL	255	0.1275	17	031
Teknor Apex Co	Pawtucket, RI	10	0.005	44	007
Hoechst Celanese	Florence, KY	10	0.005	21	015
Quantum Chemical	Fairport Harbor, OH	500	0.25	39	085
1990 Annual Emission Estimate =			2.16	tons cadmium compound	

Estimate: 4320 lbs cadmium emissions 1990 x (1 ton / 2000 lb) = 2.16 tons cadmium compounds emitted in 1990 from the manufacturing of cadmium pigments in plastics.

Methodology:

The activity data used to calculate the HAPs on the following page were taken from the Section 112(c)(6) report {EPA, 1997}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. All emission factors provided by ESD apply to all types of coal combustion. These emission factors are from 10 facilities firing bituminous, 8 facilities firing subbituminous, and 1 facility firing lignite. Factors apply to boilers utilizing both wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator or fabric filter:

Acetaldehyde	Chlorobenzene	Isophorone	Phenol
Acetophenone	Ethylbenzene	Methyl Bromide	Propionaldehyde
Acrolein	Ethylene Dichloride	Methyl Chloride	Styrene
Benzene	Formaldehyde	Methyl Ethyl Ketone	Tetrachloroethylene
Bis(2-ethylhexyl) Phthalate	Hexane	Methylene Chloride	Toluene
Carbon Disulfide			

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. These emission factors are from 11 facilities firing bituminous, 15 facilities firing subbituminous, and 2 facilities firing lignite. Factors apply to boilers utilizing either venturi scrubbers, spray dryer absorbers, or wet limestone scrubbers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator, fabric filter, or venturi scrubber:

Antimony	Cadmium	Lead	Nickel
Arsenic	Chromium	Manganese	Selenium
Beryllium	Cobalt	Mercury	

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for hydrogen chloride and hydrogen fluoride.

The Emission Standards Division {Porter, 1998} supplied emission factors for dioxins/furans (as toxic equivalency units) and POM as 16 PAH.

<u>References</u>:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Anthracite Coal Combustion, 1990

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1) (tons coal burned/year)	National Emissions (tons/year)
acetaldehyde	5.7E-04	Reference 2, 3	4.93E+05	1.41E-01
acetophenone	1.5E-05	Reference 2, 3	4.93E+05	3.70E-03
acrolein	2.9E-04	Reference 2, 3	4.93E+05	7.15E-02
benzene	1.3E-03	Reference 2, 3	4.93E+05	3.20E-01
bis(2-ethylhexyl)phthalate	7.3E-05	Reference 2, 3	4.93E+05	1.80E-02
carbon disulfide	1.3E-04	Reference 2, 3	4.93E+05	3.20E-02
chlorobenzene	2.2E-05	Reference 2, 3	4.93E+05	5.42E-03
dioxins/furans (TEQ units)	3.5E-12	Reference 2	4.93E+05	8.63E-10
ethylbenzene	9.4E-05	Reference 2, 3	4.93E+05	2.32E-02
ethylene dichloride	4.0E-05	Reference 2, 3	4.93E+05	9.86E-03
formaldehyde	2.4E-04	Reference 2, 3	4.93E+05	5.92E-02
hexane	6.7E-05	Reference 2, 3	4.93E+05	1.65E-02
hydrogen chloride	1.2E+00	Reference 2, 3	4.93E+05	2.96E+02
hydrogen fluoride	1.5E-01	Reference 2, 3	4.93E+05	3.70E+01
isophorone	5.8E-04	Reference 2, 3	4.93E+05	1.43E-01
methyl bromide	1.6E-04	Reference 2, 3	4.93E+05	3.94E-02
methyl chloride	5.3E-04	Reference 2, 3	4.93E+05	1.31E-01
methyl ethyl ketone	3.9E-04	Reference 2, 3	4.93E+05	9.61E-02
methylene chloride	2.9E-04	Reference 2, 3	4.93E+05	7.15E-02
phenol	1.6E-05	Reference 2, 3	4.93E+05	3.94E-03
POM as 16-PAH	1.9E-05	Reference 2	4.93E+05	4.68E-03
propionaldehyde	3.8E-04	Reference 2, 3	4.93E+05	9.37E-02
styrene	2.5E-05	Reference 2, 3	4.93E+05	6.16E-03
tetrachloroethylene	4.3E-05	Reference 2, 3	4.93E+05	1.06E-02
toluene	2.4E-04	Reference 2, 3	4.93E+05	5.92E-02

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Anthracite Coal Combustion, 1990

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1) (tons coal burned/year)	National Emissions (tons/year)
antimony	1.8E-05	Reference 2, 3	4.93E+05	4.44E-03
arsenic	4.1E-04	Reference 2, 3	4.93E+05	1.01E-01
beryllium	2.1E-05	Reference 2, 3	4.93E+05	5.18E-03
cadmium	5.1E-05	Reference 2, 3	4.93E+05	1.26E-02
chromium	2.6E-04	Reference 2, 3	4.93E+05	6.41E-02
cobalt	1.0E-04	Reference 2, 3	4.93E+05	2.47E-02
lead	4.2E-04	Reference 2, 3	4.93E+05	1.04E-01
manganese	4.9E-04	Reference 2, 3	4.93E+05	1.21E-01
mercury	8.3E-05	Reference 2, 3	4.93E+05	2.05E-02
nickel	2.8E-04	Reference 2, 3	4.93E+05	6.90E-02
selenium	1.3E-03	Reference 2, 3	4.93E+05	3.20E-01

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

The activity data used for calculating the HAPs on the following pages are from the Section 112(c)(6) report {EPA, 1997} and the Energy Information Administration {EIA, 1992}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. These emission factors are from 10 facilities firing bituminous, 8 facilities firing subbituminous, and 1 facility firing lignite. Factors apply to boilers utilizing both wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator or fabric filter:

Acetaldehyde	Chlorobenzene	Isophorone	Phenol
Acetophenone	Ethylbenzene	Methyl Bromide	Propionaldehyde
Acrolein	Ethylene Dichloride	Methyl Chloride	Styrene
Benzene	Formaldehyde	Methyl Ethyl Ketone	Tetrachloroethylene
Bis(2-ethylhexyl) Phthalate	Hexane	Methylene Chloride	Toluene
Carbon Disulfide			

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. These emission factors are from 11 facilities firing bituminous, 15 facilities firing subbituminous, and 2 facilities firing lignite. Factors apply to boilers utilizing either venturi scrubbers, spray dryer absorbers, or wet limestone scrubbers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator, fabric filter, or venturi scrubber:

Antimony	Beryllium	Chromium	Lead	Mercury	Selenium
Arsenic	Cadmium	Cobalt	Manganese	Nickel	

The Emission Standards Division {Porter, 1998} supplied emission factors for hydrogen chloride and hydrogen fluoride based on AP-42 {US EPA, 1996}. The Emission Standards Division {Porter, 1998} supplied emission factors for dioxins/furans (as toxic equivalency units) and POM as 16 PAH.

<u>References</u>:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 39-344, 1992.

3. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

4. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Bituminous and Lignite Coal Combustion, 1990

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1, 2) (tons coal burned/year)	National Emissions (tons/year)
acetaldehyde	5.7E-04	Reference 3, 4	3.58E+06	1.02E+00
acetophenone	1.5E-05	Reference 3, 4	3.58E+06	2.69E-02
acrolein	2.9E-04	Reference 3, 4	3.58E+06	5.19E-01
benzene	1.3E-03	Reference 3, 4	3.58E+06	2.33E+00
bis(2-ethylhexyl)phthalate	7.3E-05	Reference 3, 4	3.58E+06	1.31E-01
carbon disulfide	1.3E-04	Reference 3, 4	3.58E+06	2.33E-01
chlorobenzene	2.2E-05	Reference 3, 4	3.58E+06	3.94E-02
dioxins/furans (TEQ units)	3.5E-12	Reference 3	3.58E+06	6.27E-09
ethylbenzene	9.4E-05	Reference 3, 4	3.58E+06	1.68E-01
ethylene dichloride	4.0E-05	Reference 3, 4	3.58E+06	7.16E-02
formaldehyde	2.4E-04	Reference 3, 4	3.58E+06	4.30E-01
hexane	6.7E-05	Reference 3, 4	3.58E+06	1.20E-01
hydrogen chloride	1.2E+00	Reference 3, 4	3.58E+06	2.15E+03
hydrogen fluoride	1.5E-01	Reference 3, 4	3.58E+06	2.69E+02
isophorone	5.8E-04	Reference 3, 4	3.58E+06	1.04E+00
methyl bromide	1.6E-04	Reference 3, 4	3.58E+06	2.86E-01
methyl chloride	5.3E-04	Reference 3, 4	3.58E+06	9.49E-01
methyl ethyl ketone	3.9E-04	Reference 3, 4	3.58E+06	6.98E-01
methylene chloride	2.9E-04	Reference 3, 4	3.58E+06	5.19E-01
phenol	1.6E-05	Reference 3, 4	3.58E+06	2.86E-02
POM as 16-PAH	1.9E-05	Reference 3	3.58E+06	3.40E-02
propionaldehyde	3.8E-04	Reference 3, 4	3.58E+06	6.80E-01
styrene	2.5E-05	Reference 3, 4	3.58E+06	4.48E-02
tetrachloroethylene	4.3E-05	Reference 3, 4	3.58E+06	7.70E-02
toluene	2.4E-04	Reference 3, 4	3.58E+06	4.30E-01

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 39-344, 1992.
3. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
4. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Bituminous and Lignite Coal Combustion, 1990

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1, 2) (tons coal burned/year)	National Emissions (tons/year)
antimony	1.8E-05	Reference 3, 4	3.58E+06	3.22E-02
arsenic	4.1E-04	Reference 3, 4	3.58E+06	7.34E-01
beryllium	2.1E-05	Reference 3, 4	3.58E+06	3.76E-02
cadmium	5.1E-05	Reference 3, 4	3.58E+06	9.13E-02
chromium	2.6E-04	Reference 3, 4	3.58E+06	4.65E-01
cobalt	1.0E-04	Reference 3, 4	3.58E+06	1.79E-01
lead	4.2E-04	Reference 3, 4	3.58E+06	7.52E-01
manganese	4.9E-04	Reference 3, 4	3.58E+06	8.77E-01
mercury	8.3E-05	Reference 3, 4	3.58E+06	1.49E-01
nickel	2.8E-04	Reference 3, 4	3.58E+06	5.01E-01
selenium	1.3E-03	Reference 3, 4	3.58E+06	2.33E+00

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 39-344, 1992.
3. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
4. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

The activity data used for calculating the HAPs on the following page were taken from the Section 112(c)(6) report {EPA, 1997}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996a} for benzene, formaldehyde, and POM as 16-PAH. Data are for residual oil fired boilers. POM as 16-PAH was calculated by summing the emission factors for fifteen PAH (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b,k) fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene). The formaldehyde emission factor is based only on data from utilities using No. 6 oil.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996a} for arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, and selenium. Data are for residual oil fired boilers. Eighteen out of 19 sources were uncontrolled and 1 source was controlled with a low efficiency electrostatic precipitator.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

The Section 112(k) report (EPA, 1996b) was used for estimating the number of facilities.

<u>References</u>:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996a.

4. U.S. Environmental Protection Agency. Support for Development of Section 112(k) National Strategy Options For Candidate Urban Area Source HAPs. Final Report. Research Triangle Park, North Carolina. October 1996b.

Subcategory - Commercial/Institutional Heating: Distillate Oil Combustion

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Distillate Oil Combustion, 1990

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1) (MM Btu oil burned/year)	National Emissions (tons/year)
acetaldehyde	3.5E-05	Reference 2	4.87E+08	8.52E+00
benzene	1.5E-06	Reference 2, 3	4.87E+08	3.65E-01
formaldehyde	2.4E-04	Reference 2, 3	4.87E+08	5.84E+01
POM as 16-PAH	8.4E-06	Reference 2, 3	4.87E+08	2.05E+00

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Emission Factor in lb/thousand gal to lb/MM Btu

	lb/thousand gal	lb/MM Btu	MM Btu/thousand gal
Benzene	2.14E-04	1.5E-06	140
Formaldehyde	3.30E-02	2.4E-04	140
POM as 16 PAH	1.19E-03	8.5E-06	140
Acenaphthene	2.11E-05		
Acenapthylene	2.53E-07		
Anthracene	1.22E-06		
Benz(a)anthracene	4.01E-06		
Benzo(b,k)fluoranthene	1.48E-06		
Benzo(g,h,i)perylene	2.26E-06		
Chrysene	2.38E-06		
Dibenzo(a,h)anthracene	1.67E-06		
Fluoranthene	4.84E-06		
Fluorene	4.47E-06		
Indeno(1,2,3-c,d)pyrene	2.14E-06		
Naphthalene	1.13E-03		
Phenanthrene	1.05E-05		
Pyrene	4.25E-06		

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Distillate Oil Combustion, 1990

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1) (MM Btu oil burned/year)	National Emissions (tons/year)
arsenic	4.0E-06	Reference 2, 3	4.87E+08	9.74E-01
beryllium	3.0E-06	Reference 2, 3	4.87E+08	7.31E-01
cadmium	3.0E-06	Reference 2, 3	4.87E+08	7.31E-01
chromium	3.0E-06	Reference 2, 3	4.87E+08	7.31E-01
lead	9.0E-06	Reference 2, 3	4.87E+08	2.19E+00
manganese	6.0E-06	Reference 2, 3	4.87E+08	1.46E+00
mercury	3.0E-06	Reference 2, 3	4.87E+08	7.31E-01
nickel	3.0E-06	Reference 2, 3	4.87E+08	7.31E-01
selenium	1.5E-05	Reference 2, 3	4.87E+08	3.65E+00

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Emission Factor in lb/trillion Btu to lb/MM Btu

	lb/trillion Btu	lb/MM Btu	MM Btu/trillion Btu
Arsenic	4.00E+00	4.0E-06	1.00E+06
Beryllium	3.00E+00	3.0E-06	1.00E+06
Cadmium	3.00E+00	3.0E-06	1.00E+06
Chromium	3.00E+00	3.0E-06	1.00E+06
Lead	9.00E+00	9.0E-06	1.00E+06
Manganese	6.00E+00	6.0E-06	1.00E+06
Mercury	3.00E+00	3.0E-06	1.00E+06
Nickel	3.00E+00	3.0E-06	1.00E+06
Selenium	1.50E+01	1.5E-05	1.00E+06

Methodology:

The activity level for commercial/institutional heating natural gas combustion comes from Section 112(c)(6) report {EPA, 1997} based on information from the Energy Information Administration {EIA, 1992}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for benzene, formaldehyde, and POM as 16-PAH. Data are for all natural gas combustion sources. POM as 16-PAH was calculated by summing the emission factors for the five PAH (fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene) which had emission factors reported above the method detection limit.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp. 39-344, 1992.

3. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

4. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Natural Gas Combustion, 1990

Pollutant	Emission Factor (lb/MM Btu NG)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu NG burned/year)	National Emissions (tons/year)
acetaldehyde	1.3E-08	Reference 2	2.68E+09	1.74E-02
benzene	2.1E-06	Reference 2, 3	2.68E+09	2.81E+00
formaldehyde	7.5E-05	Reference 2, 3	2.68E+09	1.00E+02
POM as 16-PAH	6.4E-07	Reference 2, 3	2.68E+09	8.57E-01

References:

1. U.S. Environmental Protection Agency. 1990 Emissions Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachloro-dibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. April 1998.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in cubic feet to MM Btu

Activity level, cubic feet =	2.68E+12	scf/year		
		Btu/scf	1.00E+03	
		MMBtu/Btu	1.00E-06	
Activity level, MM Btu =		2.68E+09	MM Btu/yr	

Conversion of Emission Factor in lb/million scf to lb/MM Btu

	lb/million scf	lb/MM Btu	MM Btu/million scf
Benzene	2.10E-03	2.1E-06	1000
Formaldehyde	7.50E-02	7.5E-05	1000
POM as 16 PAH	6.38E-04	6.4E-07	1000
Acenaphthene	<0.0000018		
Acenapthylene	<0.0000018		
Anthracene	<0.0000024		
Benz(a)anthracene	<0.0000018		
Benzo(a)pyrene	<0.0000012		
Benzo(b)fluoranthene	<0.0000018		
Benzo(g,h,i)perylene	<0.0000012		
Benzo(k)fluoranthene	<0.0000018		
Chrysene	<0.0000018		
Dibenzo(a,h)anthracene	<0.0000012		
Fluoranthene	3.00E-06		
Fluorene	2.80E-06		
Indeno(1,2,3-c,d)pyrene	<0.0000018		
Naphthalene	6.10E-04		
Phenanthrene	1.70E-05		
Pyrene	5.00E-06		

Methodology:

Emissions from combustion boilers burning POTW digester gas were estimated using derived digester gas production data and emission factors provided by the Emissions Standards Division.

There were no direct data available for digester gas production. The estimate of national digester gas production was derived from a calculation for methane emissions from digester gas production contained in the following reference source:

> Mangino, J. and Sutton, L. Evaluation of Greenhouse Gas Emissions from Wastewater Treatment Systems. Report prepared by Radian Corporation for Susan Thorneloe, Air and Energy Engineering Research Laboratory, U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. April, 1992.

This reference provided a formula from which digester gas production could be estimated in terms of total volume of gas produced on a national level. In order to use the available emission factors, this volume was converted to energy units using a heating value for digester gas published in the following reference:

> Salvato, Joseph A. Environmental Engineering and Sanitation. Third Edition. John Wiley and Sons. New York. 1982

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for benzene, formaldehyde, and POM as 16-PAH. Data are for all natural gas combustion sources. POM as 16-PAH was calculated by summing the emission factors for the five PAH (fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene) which had emission factors reported above the method detection limit.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

<u>Emission Factor References</u>:

Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for POTW Digester Gas Combustion, 1988

Pollutant	Emission Factor (lb/MM Btu NG)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu NG burned/year)	National Emissions (tons/year)
acetaldehyde	1.3E-08	Reference 3	4.32E+07	2.81E-04
benzene	2.1E-06	Reference 3, 4	4.32E+07	4.54E-02
formaldehyde	7.5E-05	Reference 3, 4	4.32E+07	1.62E+00
POM as 16-PAH	6.4E-07	Reference 3, 4	4.32E+07	1.38E-02

References:
1. U.S. Environmental Protection Agency. Evaluation of Greenhouse Gas Emissions from Wastewater Treatment Systems. Research Triangle Park, North Carolina. April 1992.
2. Salvato, Joseph A. Environmental Engineering and Sanitation. Third Edition. Johh Wiley and Sons. New York. 1982.
3. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
4. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in m^3/day of wastewater to MM Btu/year of POTW digester gas

Activity level, m^3/day	6.55E+07	wastewater	3.65E+02	days/year
		Activity level, m^3/year =	2.39E+10	wastewater
	scm gas/m^3 wastewater =	8.00E-02	3.53E+01	scf/scm
		Activity level, scm/year =	1.91E+09	POTW gas
		Activity level, scf/year =	6.75E+10	POTW gas
		higher heating value =	6.40E+02	Btu/scf
			1.00E-06	MM Btu/Btu
Activity level, MM Btu =		4.32E+07	MM Btu/yr	

Conversion of Emission Factor in lb/million scf to lb/MM Btu:

	lb/million scf	lb/MM Btu	MM Btu/million scf
Benzene	2.10E-03	2.1E-06	1000
Formaldehyde	7.50E-02	7.5E-05	1000
POM as 16 PAH	0.00E+00	0.0E+00	1000

Acenaphthene	<0.0000018	Chrysene	<0.0000018
Acenapthylene	<0.0000018	Dibenzo(a,h)anthracene	<0.0000012
Anthracene	<0.0000024	Fluoranthene	3.00E-06
Benz(a)anthracene	<0.0000018	Fluorene	2.80E-06
Benzo(a)pyrene	<0.0000012	Indeno(1,2,3-c,d)pyrene	<0.0000018
Benzo(b)fluoranthene	<0.0000018	Naphthalene	6.10E-04
Benzo(g,h,i)perylene	<0.0000012	Phenanthrene	1.70E-05
Benzo(k)fluoranthene	<0.0000018	Pyrene	5.00E-06

Methodology:

The activity data used to estimate the HAP emissions on the following page were taken from the Section 112(c)(6) report {EPA, 1997}.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996a} for benzene, formaldehyde, and POM as 16-PAH. Data are for residual oil fired boilers. POM as 16-PAH was calculated by summing the emission factors for fifteen PAH (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b,k) fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene). The formaldehyde emission factor is based only on data from utilities using No. 6 oil.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996a} for arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, nickel, and selenium. Data are for residual oil fired boilers. Eighteen out of 19 sources were uncontrolled and 1 source was controlled with a low efficiency electrostatic precipitator.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

The estimate of number of facilities comes from the Section 112(k) report {EPA, 1996b}.

<u>References</u>:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996a.

4. U.S. Environmental Protection Agency. Support for Development of Section 112(k) National Strategy Options For Candidate Urban Area Source HAPs. Final Report. Research Triangle Park, North Carolina. October 1996b.

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Residual Oil Combustion, 1992

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1) (MM Btu oil burned/year)	National Emissions (tons/year)
acetaldehyde	3.5E-05	Reference 2	3.75E+08	6.56E+00
benzene	1.5E-06	Reference 2, 3	3.75E+08	2.81E-01
formaldehyde	2.4E-04	Reference 2, 3	3.75E+08	4.50E+01
POM as 16-PAH	8.4E-06	Reference 2, 3	3.75E+08	1.58E+00

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Emission Factor in lb/thousand gal to lb/MM Btu

	lb/thousand gal	lb/MM Btu	MM Btu/thousand gal
Benzene	2.14E-04	1.5E-06	140
Formaldehyde	3.30E-02	2.4E-04	140
POM as 16 PAH	1.19E-03	8.5E-06	140
Acenaphthene	2.11E-05		
Acenapthylene	2.53E-07		
Anthracene	1.22E-06		
Benz(a)anthracene	4.01E-06		
Benzo(b,k)fluoranthene	1.48E-06		
Benzo(g,h,i)perylene	2.26E-06		
Chrysene	2.38E-06		
Dibenzo(a,h)anthracene	1.67E-06		
Fluoranthene	4.84E-06		
Fluorene	4.47E-06		
Indeno(1,2,3-c,d)pyrene	2.14E-06		
Naphthalene	1.13E-03		
Phenanthrene	1.05E-05		
Pyrene	4.25E-06		

Methodology:

Nationwide Emissions from Commercial/Institutional Heating for Residual Oil Combustion, 1992

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1) (MM Btu oil burned/year)	National Emissions (tons/year)
arsenic	9.4E-06	Reference 2, 3	3.75E+08	1.76E+00
beryllium	2.0E-07	Reference 2, 3	3.75E+08	3.75E-02
cadmium	2.8E-06	Reference 2, 3	3.75E+08	5.25E-01
chromium	6.0E-06	Reference 2, 3	3.75E+08	1.13E+00
lead	1.1E-05	Reference 2, 3	3.75E+08	2.06E+00
manganese	2.1E-05	Reference 2, 3	3.75E+08	3.94E+00
mercury	8.1E-07	Reference 2, 3	3.75E+08	1.52E-01
nickel	6.0E-04	Reference 2, 3	3.75E+08	1.13E+02
selenium	4.9E-06	Reference 2, 3	3.75E+08	9.19E-01

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Emission Factor in lb/thousand gal to lb/MM Btu

	lb/thousand gal	lb/MM Btu	MM Btu/thousand gal
Arsenic	1.32E-03	9.4E-06	140
Beryllium	2.78E-05	2.0E-07	140
Cadmium	3.98E-04	2.8E-06	140
Chromium	8.45E-04	6.0E-06	140
Lead	1.51E-03	1.1E-05	140
Manganese	3.00E-03	2.1E-05	140
Mercury	1.13E-04	8.1E-07	140
Nickel	8.45E-02	6.0E-04	140
Selenium	6.83E-04	4.9E-06	140

Methodology:

The activity data used for the HAP estimates on the following page were taken from the Section 112(c)(6) report {EPA, 1997}. The Polycyclic Organic Matter as EOM estimate was taken from this report, as well.

Emission factors for formaldehyde, hydrogen chloride, arsenic, cadmium, chromium, lead, mercury, and manganese including all metal compounds were supplied by the Emissions Standards Division {Porter, 1998} based on information in the AP-42 database {EPA, 1996a}. The conversion factor of 9.0 MM Btu/ton fuel burned is also taken directly from the AP-42 database (1996). All emission factors were taken from uncontrolled combustors.

The Emission Standards Division {Porter, 1998} also supplied emission factors for POM as 16 PAH, dioxin/furan in toxic equivalency units, and nickel.

The Section 112(k) report {EPA, 1996b} was used for estimate of number of facilities.

References:

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996a.

U.S. Environmental Protection Agency. Support for Development of Section 112(k) National Strategy Options For Candidate Urban Area Source HAPs. Final Report. Research Triangle Park, North Carolina. October 1996b.

Methodology:

Activity:		2.72E+07	MM Btu from commercial sector in 1990 (from 112(c)(6) report)			
	divided by	9.00E+00	MM Btu/ton (from AP-42)			
		3.02E+06	**ton from commercial sector in 1990**			
					Estimate	**Estimate**
Pollutant Name				**Factor (lb/ton)**	**(tons/yr)**	**(lb./yr)**
Arsenic & Compounds (inorganic including Arsine)				8.50E-05	1.28E-01	2.57E+02
Cadmium and Compounds				2.10E-05	3.17E-02	6.35E+01
Chromium and Compounds				1.60E-04	2.42E-01	4.84E+02
Dioxins/Furans (as TEQ units)				2.50E-09	3.78E-06	7.56E-03
Formaldehyde				8.20E-03	1.24E+01	2.48E+04
Hydrogen Chloride				7.80E-03	1.18E+01	2.36E+04
Lead and Compounds				4.50E-04	6.80E-01	1.36E+03
Manganese and Compounds				1.30E-02	1.96E+01	3.93E+04
Mercury and Compounds				5.20E-06	7.86E-03	1.57E+01
Nickel and Compounds				2.10E-05	3.17E-02	6.35E+01
POM as 16 PAH				3.50E-03	5.29E+00	1.06E+04
Sample calculation:						
0.000085 lb. Arsenic				3.02 e+6 tons of wood/wood		1 ton Arsenic
ton of wood/wood waste burned with 50 % moisture						2000 lb. Arsenic

Methodology:

Mercury estimates were reported in the 112(c)(6) report.

REFERENCES

(112(c)(6) Report)
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Mercury estimates were reported in the 112(c)(6) report.

REFERENCES

(112(c)(6) Report)
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Approach: 1990 estimates of emissions from manufacturing of lead oxides in pigments are from the document "National Air Pollutant Emission Trends 1990 - 1994", October 1995.

Estimate: 136 short tons lead compounds emitted in 1990 from inorganic chemical manufacture of lead oxide in pigments.

References:
U. S. Environmental Protection Agency. National Air Pollution Emission Trends 1990 - 1994. EPA-454/R-95-011. Research Triangle Park, North Carolina. October 1995.

Methodology:

The Mercury estimate for Lime Manufacturing is from the 112(c)(6) Report.[1]

The remaining HAP estimates for Lime Manufacturing were taken from the TRI database based on the following SIC Code: 3724 (Lime).[2]

Reference

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetratchlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

Marine Vessel Loading Operations

The following HAP estimates were taken from a summary table provided by David Markwordt in support of 40 CFR Part 63 Subpart Y:

Benzene
Toluene
Hexane
Xylene
Methanol

Reference

Summary information from David Markwordt to Barbara Driscoll, Table 1. Marine Vessel Loading Operations, 1990 HAP emissions, CFR Part 63 Subpart Y, June 5, 1997.

Methodology:

Medical Waste Incineration can be broken into three types of incineration: Controlled Air, Excess Air, and Rotary Kiln. Approximately 95 % are controlled air, 2 % are excess air, and 1% are rotary kiln. Approximately 2 % of all incinerators are equipped with air pollution control devices. Control devices include Low Energy Scrubber, Medium Energy Scrubber, High Energy Scrubber, FF (Fabric Filter), DSI (Dry Sorbent Injector), Carbon Injection, ESP (Electrostatic Precipitator), SD (Spray Dryer), or a combination of these. {US EPA, 1996}

The 112(c)(6) report estimates 16-PAH emissions to be 0.80 tons/yr. {U.S. EPA, 1997}

National emissions of Arsenic, Cadmium, Chromium, Formaldehyde, Hydrochloric Acid, Lead, Manganese, Mercury, and Nickel for Medical Waste Incineration will be estimated using the uncontrolled emission factors (which accounts for 98% of the medical waste incinerators).

There are no emission factors available for excess air incinerators. Controlled Air and Rotary Kiln account for 96% of the Medical Waste Incinerators. The adjusted weight percentages are as follows:

Controlled air: ((100 %)/(100 % - (100 % - 96 %)) x (95 %)) = 98.958 %
Rotary kiln: ((100 %)/(100 % - (100 % - 96 %)) x (1 %)) = 1.042 %

The activity level of 1.73 million tons of waste incinerated per year and number of facilities (3,400) for Medical Waste Incineration comes from Rick Copland {Copland, 1997}.

The emission factors for Arsenic, Chromium, Formaldehyde, Hydrochloric Acid, Manganese, and Nickel come from AP-42 {US EPA, 1996}. The emission factors for Cadmium, Formaldehyde, Hydrochloric Acid, and Lead come from the Emissions Standards Division {Porter, 1998} based on numbers in AP-42 {US EPA, 1996}. The emission factor of 0.00000076 pounds per ton for Dioxin/Furans as toxic equivalency units comes from the Emissions Standards Division {Porter, 1999}. The emission factor for Mercury also comes from the Emissions Standards Division (Porter, 1999).

<u>References</u>

U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Telephone conversation between Rick Copland, U.S. EPA and Jack Johnson, Eastern Research Group, Inc. Medical waste incinerator data. January 7, 1997.

Porter, Fred L., U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions, Monitoring and Analysis Division. Comments on medical waste incineration information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

Porter, Fred L., U.S. Environmental Protection Agency, Emission Standards Division. Note to B. Driscoll, U.S. EPA. Comments on medical waste incinertion emission factors for dioxin/furans and mercury. January 27, 1999.

Methodology:

Calculating National Estimates for Cadmium, Lead, and Mercury Compounds, Dioxin/Furans (as TEQs), Formaldehyde, and Hydrogen Chloride

Activity Level = 1.73E+06 tons of waste incinerated

All waste will be assumed to be incinerated using uncontrolled controlled air incineration.

Nationwide Emissions from Medical Waste Incineration, 1990

Pollutant	Emission Factor (lb/ton)	Emission Factor Reference	National Activity Level (Reference 1) (tons waste burned/year)	National Emissions (tons/year)
Cadmium	5.5E-03	Reference 2, 3	1.73E+06	4.76E+00
Dioxin/Furans (as TEQs)	7.6E-07	Reference 4	1.73E+06	6.57E-04
Formaldehyde	1.6E-03	Reference 2, 3	1.73E+06	1.38E+00
Hydrogen Chloride	3.4E+01	Reference 2, 3	1.73E+06	2.94E+04
Lead	7.3E-02	Reference 2, 3	1.73E+06	6.31E+01
Mercury	5.8E-02	Reference 4	1.73E+06	5.02E+01

Example Calculation:

National Emissions (tons/year) = Emission Factor (lb/ton) x National Activity Level (tons/year)/2000 lb/ton

National Cadmium Emissions (tons/year) =0.0055 lb/ton x 1,730,000 tons/yr/2000 lb/ton = 4.76 tons/year

References:

1. Telephone conversation between Rick Copland, U.S. EPA and Jack Johnson, Eastern Research Group, Inc. Medical waste incinerator data. January 7, 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Medical Waste Incineration information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

4. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to B. Driscoll, U.S. EPA. Comments on medical waste incineration emission factors for dioxins and mercury. January 27, 1999.

APPENDIX A: NATIONAL ESTIMATES - Medical Waste Incinerators

Methodology:

Calculating National Estimates for Arsenic								
Activity Level =		1.73E+06	tons of waste incinerated					
The following is a breakdown of controlled vs uncontrolled								
	Uncontrolled emissions =	98	%					
	Controlled emissions =	2	%					
Only uncontrolled emissions will be estimated, and the emissions will be adjusted to 100%								
The adjusted weighting schemes								
	type	adjusted %						
	Controlled Air	98.958						
	Rotary Kiln	1.042						
Emission Factors		EF (lb/ton)	Weigted emission factor (%)			Emissions (lbs)		
Controlled Air Uncontrolled =		2.42E-04		98.958		414.29756		
Rotary Kiln Uncontrolled =		3.32E-04		1.042		5.9848312		
		Average Uncontrolled =		100		420.28239	lb/yr	
						0.2101412	ton/yr	

Methodology:

Calculating National Estimates for Chromium Compounds							
Activity Level =		1.73E+06	tons of waste incinerated				
The following is a breakdown of controlled vs uncontrolled							
	Uncontrolled emissions =	98	%				
	Controlled emissions =	2	%				
Only uncontrolled emissions will be estimated, and the emissions will be adjusted to 100%							
The adjusted weighting schemes							
	type	adjusted %					
	Controlled Air	98.958					
	Rotary Kiln	1.042					
Emission Factors		EF (lb/ton)	Weigted emission factor (%)		Emissions (lbs)		
Controlled Air Uncontrolled =		7.75E-04		98.958		1326.7794	
Rotary Kiln Uncontrolled =		4.43E-03		1.042		79.857838	
		Average Uncontrolled =		100		1406.6372	lb/yr
						0.7033186	ton/yr

Methodology:

Calculating National Estimates for Manganese								
Activity Level =		1.73E+06	tons of waste incinerated					
The following is a breakdown of controlled vs uncontrolled								
	Uncontrolled emissions =	98	%					
	Controlled emissions =	2	%					
Only uncontrolled emissions will be estimated, and the emissions will be adjusted to 100%								
The adjusted weighting schemes								
	type	adjusted %						
	Controlled Air	100						
Emission Factors		EF (lb/ton)	Weigted emission factor (%)			Emissions (lbs)		
Controlled Air Uncontrolled =		5.67E-04		100		980.91		
		Average Uncontrolled =		100		980.91	lb/yr	
						0.490455	ton/yr	

APPENDIX A: NATIONAL ESTIMATES - Medical Waste Incinerators

Methodology:

Calculating National Estimates for Nickel Compounds							
Activity Level =		1.73E+06	tons of waste incinerated				
The following is a breakdown of controlled vs uncontrolled							
	Uncontrolled emissions =	98	%				
	Controlled emissions =	2	%				
Only uncontrolled emissions will be estimated, and the emissions will be adjusted to 100%							
The adjusted weighting schemes							
	type	adjusted %					
	Controlled Air	98.958					
	Rotary Kiln	1.042					
Emission Factors		EF (lb/ton)	Weigted emission factor (%)		Emissions (lbs)		
Controlled Air Uncontrolled =		5.90E-04		98.958	1010.0643		
Rotary Kiln Uncontrolled =		3.53E-03		1.042	63.633898		
		Average Uncontrolled =		100	1073.6982	lb/yr	
					0.5368491	ton/yr	

Methodology:

Summary of Emission Estimation Method for Mineral Wool Production

The 1990 emission estimates for mineral wool production were provided by Mary Johnson, U.S. Environmental Protection Agency (reference 1). Carbonyl sulfide emissions from cupolas are not regulated by the NESHAP. Also, emissions from fiber collection, curing, and cooling processes are not regulated by the NESHAP.

Reference:

1. Johnson, Mary, U.S. Environmental Protection Agency. "Inventory Info." Email to Darcy Wilson, Eastern Research Group. July 17, 1998.

Methodology:

1990 Baseline Emission Estimates for Mineral Wool Production					
	Process Emissions				
Pollutant	Total Annual Cupola Emissions (ton/yr)	Total Annual Fiber Collection Emissions (ton/yr)	Total Annual Curing Emissions (ton/yr)	Total Annual Cooling Emissions (ton/yr)	Total Annual HAP Emissions (ton/yr)
Antimony	0.16				0.16
Arsenic	0.01				0.01
Beryllium	0.001				0.001
Cadmium	0.02				0.02
Chromium	0.07				0.07
Manganese	0.77				0.77
Nickel	0.05				0.05
Lead	0.01				0.01
Selenium	0.03				0.03
Carbonyl Sulfide	2778				2778
Formaldehyde		94.8	58.8	4.8	158.4
Phenol		236.4	15.8		252.2
Methanol		63			63

Methodology:

Aircraft- 1,3-Butadiene, Benzene, and Formaldehyde (1990)

Commercial Aircraft

For Commercial Aircraft, LTO data from table 7 of *Airport Activity Statistics of Certified Route Air Carriers* (U.S. DOT, 1990) were applied to *Aircraft Engine Emission Database Version 2.1* (U.S. DOT, 1998) to estimate total hydrocarbon (HC) emissions (see spreadsheet below).

Note that the *Aircraft Engine Emission Database Version 2.1* (U.S. DOT, 1998) did not have all aircraft models and in some cases models were included in the database but no engine information was associated with a given model. Such that for the 87 aircraft models that were used in the commercial aircraft fleet in 1990, emission estimates could be calculated specifically for only 40 aircraft models. Relative to landing and take-off (LTO) cycles, emissions for 76.29 percent of LTOs could be matched to data in the *Aircraft Emission Database Version 2.1* (U.S. DOT, 1998). To compensate for the missing engine data, the HC estimate provided in the spreadsheet below was adjusted by using a ratio of total national 1990 LTOs noted in *Airport Activity Statistics of Certified Route Air Carriers* (U.S. DOT, 1990) and the actual total used in *Aircraft Engine Emission Database Version 2.1* (U.S. DOT, 1998).

26,291 tons of HC X (6,572,179 Total 1990 LTOs/5,014,135 LTOs used in FAA database) = 34,460 tons of HC

A correction factor from *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992), was applied to the commercial aircraft HC emission estimate to obtain a VOC estimate.

34,460 tons of HC X 1.0947 VOC/HC = 37,723 tons of VOC

To estimate 1,3-butadiene, benzene, and formaldehyde emissions for commercial aircraft it is necessary to convert VOC to TOG. Conversion factors were included in the Rich Cook memorandum (Cook, 1997).

37,723 tons of VOC X 1.1167 TOG/VOC = 42,125 tons of TOG

1,3-butadiene, benzene and formaldehyde fractions of TOG for commercial aircraft were provided in the same memorandum (Cook, 1997) and were applied to the above TOG value.

42,125 tons of TOG X 0.0180 1,3-butadiene fraction = **758.25 tons of 1,3-butadiene**
42,125 tons of TOG X 0.0194 benzene fraction = **817.23 tons of benzene**
42,125 tons of TOG X 0.1501 formaldehyde fraction= **6,322.96 tons of formaldehyde**

Air Taxis

For air taxis, 1990 activity data were taken from *Air Traffic Activity - Fiscal Year 1993* (U.S. DOT, 1993). In this reference, each FAA activity (i.e. a landing or take-off) is counted. This means that for every LTO there are two FAA activities. These 1990 data were converted to LTOs by dividing the FAA activity data by two.

8,837,671 FAA activity / 2 = 4,418,836 LTOs

These LTO data were applied to generic air taxi HC emission factors found in *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992) to estimate HC emissions.

4,418,836 LTOs X 1.234 pounds HC/LTO X 1 ton/2,000 pounds = 2,726.42 tons of HC

A correction factor from *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992) was applied to the air taxi HC emission estimate to obtain a VOC estimate.

2,726.42 tons of HC X 0.9914 VOC/HC = 2,702.97 tons of VOC

Methodology:

To estimate 1,3-butadiene, benzene, and formaldehyde for commercial aircraft it is necessary to convert VOC to TOG. Conversion factors were included in the Rich Cook memorandum (Cook, 1997).

2,702.97 tons of VOC X 1.0902 TOG/VOC = 2,946.78 tons of TOG

1,3-butadiene, benzene, and formaldehyde emissions factors for commercial aircraft were provided in the same memorandum (Cook, 1997) and were applied to the above TOG value.

2,946.78 tons of TOG X 0.0114 1,3-butadiene fraction = **33.59 tons of 1,3-butadiene**
2,946.78 tons of TOG X 0.0344 benzene fraction = **101.37 tons of benzene**
2,946.78 tons of TOG X 0.0578 formaldehyde fraction = **170.32 tons of formaldehyde**

Note, there were no TOG conversion factor or 1,3-butadiene, benzene, and formaldehyde TOG fractions for the whole air taxi fleet, instead separate values were provided for air taxis powered by piston and turbine engines. These values were weighted based on the assumption that 73 percent of the air taxi fleet is powered by piston engines and the remaining 27 percent of the fleet is powered by turbine engines as noted in memorandum from Rich Cook (Cook, 1997).

General Aviation

For General Aviation, 1990 activity data were taken from *Air Traffic Activity - Fiscal Year 1993* (U.S. EPA, 1992). These data were converted to LTOs by dividing the FAA activity data by two.

39,169,795 FAA activity / 2 = 19,584,898 LTOs

The LTOs data were applied to a generic general aviation HC emission factors found in *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources*, (U.S. EPA, 1992) to estimate HC emissions.

19,584,898 LTOs X 0.394 pounds HC/LTO X 1 ton/2,000 pounds = 3,858.22 tons of HC

A correction factor from *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992) was applied to the air taxi HC emission estimate to obtain a VOC estimate.

3,858.22 tons of HC X 0.9708 VOC/HC = 3,745.56 tons of VOC

To estimate benzene, formaldehyde, and 1,3-butadiene emissions for commercial aircraft it is necessary to convert VOC to TOG. Conversion factors were included in the memorandum from Rich Cook (Cook, 1997).

3,745.56 tons of 1.0775 VOC X TOG/VOC = 4,035.84 tons of TOG

1,3-butadiene, benzene, and formaldehyde emissions factors for general aviation were provided in the same memorandum (Cook, 1997) and were applied to the above TOG value.

4,035.84 tons of TOG X 0.0102 1,3-butadiene fraction = **41.17 tons of 1,3-butadiene**
4,035.84 tons of TOG X 0.0391 benzene fraction = **157.80 tons of benzene**
4,035.84 tons of TOG X 0.0338 formaldehyde fraction = **136.41 tons of formaldehyde**

Note there were no TOG conversion factor or 1,3-butadiene, benzene, and formaldehyde TOG fractions for general aviation, instead values were provided for air taxis powered by piston and turbine engines. These air taxi values were weighted based on the assumption that 94 percent of general aviation activities is powered by piston engines and the remaining 6 percent of the fleet is powered by turbine engines as noted in Rich Cook's memorandum (Cook, 1997).

Methodology:

Military Aircraft
Estimates for military aircraft were not possible due to the lack of information concerning the make up of the military aircraft fleet or alternatively a generic HC emission factor.

Total Aircraft Emissions (tons/year)

Pollutant	Commercial Aircraft	Air Taxis	General Aviation	**Total**
1,3-Butadiene	758.25	33.59	41.17	**833.01**
Benzene	817.23	101.37	157.80	**1,076.40**
Formaldehyde	6,322.96	170.32	136.41	**6,629.69**

References

Cook, Rich. 1997 (June 11, 1997). Memorandum entitled *Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs*, to Laurel Driver and Anne Pope, U.S. EPA, Office of Air Quality Planning and Standards. U.S. EPA, Office of Mobile Sources. Ann Arbor, MI.

U.S. Department of Transportation. 1990. *Airport Activity Statistics of Certified Air Carriers, 12 Months Ending December 31, 1990*. Federal Aviation Administration, Research and Special Programs Adminstration. Washington, DC.

U.S. Department of Transportation. 1993. *Air Traffic Activity - Fiscal Year 1993*. FAA-APO-94-10. Federal Aviation Administration, Aviation Policy, Plans and Management Analysis. Washington, DC. Internet address: http//www.apo.data.faa.gov/.

U.S. Department of Transportation. 1998 (July 15, 1998). *Aircraft Engine Emission Database Version 2.1*. Federal Aviation Administration. Washington, DC. Internet address: http://www.epa.gov/OMSWWW/aviation.htm/.

U.S. Environmental Protection Agency. 1992. *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*. EPA-450/4-81-026d (Revised). Office of Air and Radiation. Research Triangle Park, NC, and Ann Arbor, MI.

Methodology:

Aircraft- Acetaldehyde, Acrolein, POM as 16-PAH, POM as 7-PAH, and Styrene (1990)

Commercial Aircraft
For Commercial Aircraft, LTO data from table 7 of *Airport Activity Statistics of Certified Route Air Carriers* (U.S. DOT, 1990) were applied to the *Aircraft Engine Emission Database Version 2.1* (U.S. DOT, 1998) to estimate total hydrocarbon (HC) emissions (see spreadsheet below).

Note that the *Aircraft Engine Emission Database Version 2.1* (U.S. DOT, 1998) did not have all aircraft models and in some cases models were included in the database but no engine information was associated with a given model. Such that for the 87 aircraft models that were used in the commercial aircraft fleet in 1990, emission estimates could be calculated specifically for only 40 aircraft models. Relative to landing and take-off (LTO) cycles, emissions for 76.29 percent of LTOs could be matched to data in the *Aircraft Emission Database Version 2.1* (U.S. DOT, 1998). To compensate for the missing engine data, the HC estimate provided in the spreadsheet below was adjusted by using a ratio of total national 1990 LTOs noted in *Airport Activity Statistics of Certified Route Air Carriers* (U.S. DOT, 1990) and the actual total used in the Aircraft Engine Emission Database Version 2.1 (U.S. DOT, 1998).

> 26,291 tons of HC X (6,572,179 Total 1990 LTOs/5,014,135 LTOs used in FAA database) = 34,460 tons of HC

A correction factor from *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992) was applied to the commercial aircraft HC emission estimate to obtain a VOC estimate:

> 34,460 tons of HC X 1.0947 VOC/HC = 37,723 tons of VOC

The VOC estimate was speciated for acetaldehyde, acrolein, POM as 16-PAH, POM as 7-PAH, and styrene using speciation profiles in a Rich Cook memorandum (Cook, 1997).

> 37,723 tons of VOC X 0.0519 acetaldehyde/VOC= **1,957.82 tons acetaldehyde**
> 37,723 tons of VOC X 0.0253 acrolein/VOC= **954.39 tons acrolein**
> 37,723 tons of VOC X 1.166 x 10^{-4} 16-PAH/VOC= **4.40 tons POM as 16-PAH**
> 37,723 tons of VOC X 1.049 x 10^{-6} 7-PAH/VOC= **0.04 tons POM as 7-PAH**
> 37,723 tons of VOC X 0.0044 styrene/VOC= **165.98 tons styrene**

Air Taxis
For air taxis, 1990 activity data were taken from the *Air Traffic Activity - Fiscal Year 1993* (U.S. DOT, 1993). In this reference, each FAA activity (i.e. a landing or take-off) is counted. This means that for every LTO there are two FAA activities. These 1990 data were converted to LTOs by dividing the FAA activity data by two.

> 8,837,671 FAA activity / 2 = 4,418,836 LTOs

These LTO data were applied to generic air taxi HC emission factors found in *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992) to estimate HC emissions:

> 4,418,836 LTOs X 1.234 pounds HC/LTO X 1 ton/2,000 pounds = 2,726.42 tons of HC

A correction factor from *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992) was applied to the air taxi HC emission estimate to obtain a VOC estimate:

> 2,726.42 tons of HC X 0.9914 VOC/HC = 2,702.97 tons of VOC

Methodology:

The VOC estimate was speciated for acetaldehyde, acrolein, POM as 16-PAH, POM as 7-PAH, and styrene using speciation profiles a Rich Cook memorandum (Cook, 1997).

2,702.97 tons of VOC X 0.0189 acetaldehyde/VOC= **51.09 tons acetaldehyde**
2,702.97 tons of VOC X 0.0016 acrolein/VOC= **4.32 tons acrolein**
2,702.97 tons of VOC X 6.829 x 10^{-5} 16-PAH/VOC= **0.18 tons POM as 16-PAH**
2,702.97 tons of VOC X 7.234 x 10^{-6} 7-PAH/VOC= **0.02 tons POM as 7-PAH**
2,702.97 tons of VOC X 0.0037 styrene/VOC= **10.00 tons styrene**

General Aviation
For General Aviation, 1990 activity data were taken from the *Air Traffic Activity - Fiscal Year 1993* (U.S. DOT, 1993). This data were converted to LTOs by dividing the FAA activity data by two.

39,169,795 FAA activity / 2 = 19,584,898 LTOs

The LTOs data were applied to a generic general aviation HC emission factors found in *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992) to estimate HC emissions.

19,584,898 LTOs X 0.394 pounds HC/LTO X 1 ton/2,000 pounds = 3,858.22 tons of HC

A correction factor from *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (U.S. EPA, 1992) were applied to the air taxi HC emission estimate to obtain a VOC estimate.

3,858.22 tons of HC X 0.9708 VOC/HC = 3,745.56 tons of VOC

The VOC estimate was speciated for acetaldehyde, acrolein, POM as 16-PAH, POM as 7-PAH, and styrene using speciation profiles a Rich Cook memorandum (Cook, 1997).

3,745.56 tons of VOC X 0.0092 acetaldehyde/VOC= **34.46 tons acetaldehyde**
3,745.56 tons of VOC X 0.0020 acrolein/VOC= **7.49 tons acrolein**
3,745.56 tons of VOC X 2.954 X 10^{-5} 16-PAH/VOC= **0.11 tons POM as 16-PAH**
3,745.56 tons of VOC X 9.062 X 10^{-6} 7-PAH/VOC= **0.03 tons POM as 7-PAH**
3,745.56 tons of VOC X 0.0037 styrene/VOC= **13.86 tons styrene**

Military Aircraft
Estimates for military aircraft were not possible due to the lack of information concerning the make up of the military aircraft fleet or alternatively a generic HC emission factor.

Total Aircraft Emissions (tons/year)

Pollutant	Commercial Aircraft	Air Taxis	General Aviation	**Total**
Acetaldehyde	1,957.82	51.09	34.46	**2,043.37**
Acrolein	954.39	4.32	7.49	**966.20**
16- PAH	4.40	0.18	0.11	**4.69**
7-PAH	0.04	0.02	0.03	**0.09**
Styrene	165.98	10.00	13.86	**189.84**

Methodology:

References

Cook, Rich. 1997 (June 11, 1997). Memorandum entitled *Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs*, to Laurel Driver and Anne Pope, U.S. EPA, Office of Air Quality Planning and Standards. U.S. EPA, Office of Mobile Sources. Ann Arbor, MI.

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U.S. Department of Transportation. 1993. *Air Traffic Activity - Fiscal Year 1993*. FAA-APO-94-10. Federal Aviation Administration, Aviation Policy, Plans and Management Analysis. Washington, DC. Internet address: http//www.apo.data.faa.gov/.

U.S. Department of Transportation. 1998 (July 15, 1998). *Aircraft Engine Emission Database Version 2.1*. Federal Aviation Administration. Washington, DC. Internet address: http://www.epa.gov/OMSWWW/aviation.htm/.

U.S. Environmental Protection Agency. 1992. *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*. EPA-450/4-81-026d (Revised). Office of Air and Radiation. Research Triangle Park, NC, and Ann Arbor, MI.

Methodology:

			Time In mode (Minutes)						
Aircraft Model	Aircraft Manufacturer	Engine Model	Engine Manu- facturer	Idle	Take-off	Climb-out	Approach	LTOs	HC Emissions (lbs)
A300-600	AIRBUS	CF6-80C2A5 (RE	GE	26	0.70	2.20	4.00	6,136	80,234
A310-200	AIRBUS	PW4X52 PHASE 3	P&W	26	0.70	2.20	4.00	2,464	20,797
A310-300	AIRBUS	CF6-80A3	GE	26	0.70	2.20	4.00	10,348	75,704
A320-200	AIRBUS	CFM56-5-A1	CFMI	26	0.70	2.20	4.00	11,628	14,615
BAE 146-100	BAE	ALF 502R-5	TEX LYC	26	0.70	2.20	4.00	14,185	43,958
BAE 146-200	BAE	ALF 502R-5	TEX LYC	26	0.70	2.20	4.00	72,534	224,779
BAE 146-300	BAE	ALF 502R-5	TEX LYC	26	0.70	2.20	4.00	31,271	96,907
B727-100	BOEING	JT8D-7,7A & 7B	P&W	26	0.70	2.20	4.00	166,653	914,757
B727-100(CARG)	BOEING	JT8D-7B	P&W	26	0.70	2.20	4.00	58,441	894,719
B727-200	BOEING	JT8D-15 (R.E.C	P&W	26	0.70	2.20	4.00	1,192,386	3,378,108
B727-200(CARG)	BOEING	JT8D-17A	P&W	26	0.70	2.20	4.00	22,912	233,749
B737-100	BOEING	JT8D-17	P&W	26	0.70	2.20	4.00	797,737	9,305,701
B737-200 (CARG)	BOEING	JT8D-17	P&W	26	0.70	2.20	4.00	96,530	1,126,034
B737-300	BOEING	CFM56-3-B1	CFMI	26	0.70	2.20	4.00	771,652	1,421,712
B737-400	BOEING	CFM56-3C-1	CFMI	26	0.70	2.20	4.00	78,429	99,185
B737-500	BOEING	CFM56-3-B1	CFMI	26	0.70	2.20	4.00	18,544	34,166
B747	BOEING	PW4X62 PHASE 3	P&W	26	0.70	2.20	4.00	31,762	333,796
B747-200	BOEING	JT9D-59A	P&W	26	0.70	2.20	4.00	13,037	524,120
B747-400	BOEING	CF6-80C2B1 (DE	GE	26	0.70	2.20	4.00	2,436	63,445
B747F (CARG)	BOEING	JT9D-7F (MOD V	P&W	26	0.70	2.20	4.00	3,962	316,356
B747-SP	BOEING	RB211-524B		26	0.70	2.20	4.00	2,192	434,021
B757-200	BOEING	PW2037	P&W	26	0.70	2.20	4.00	232,041	542,738
B757-200(CARG)	BOEING	RB211-535E4	RR	26	0.70	2.20	4.00	571	773
B767-200	BOEING	JT9D-7R4E1	P&W	26	0.70	2.20	4.00	75,920	149,588
B767-300	BOEING	PW4060	P&W	26	0.70	2.20	4.00	33,342	87,410
F100	FOKKER	TAY MK 650-15	RR	26	0.70	2.20	4.00	34,259	108,258
L-1011-500	LOCKHEED	RB211-524B SER		26	0.70	2.20	4.00	3,712	22,919
L-1011-100	LOCKHEED	RB211-22B (REV	RR	26	0.70	2.20	4.00	68,622	11,188,682
DC10-10	MCDONNELL DOUGLAS	CF6-50C	GE	26	0.70	2.20	4.00	111,007	5,871,793
DC10-30	MCDONNELL DOUGLAS	CF6-50C	GE	26	0.70	2.20	4.00	22,074	1,167,620
DC10-40	MCDONNELL DOUGLAS	JT9D-20	P&W	26	0.70	2.20	4.00	18,938	1,516,582
DC8-61	MCDONNELL DOUGLAS	JT3D-3B	P&W	26	0.70	2.20	4.00	461	99,041
DC8-62	MCDONNELL DOUGLAS	JT3D-3B	P&W	26	0.70	2.20	4.00	798	171,442
DC8-62 (CARG)	MCDONNELL DOUGLAS	JT3D-7	P&W	26	0.70	2.20	4.00	1,223	267,040
DC8-63F (CARG)	MCDONNELL DOUGLAS	JT3D-7	P&W	26	0.70	2.20	4.00	1,343	293,242
DC9-10	MCDONNELL DOUGLAS	JT8D-7 (OLD CO	P&W	26	0.70	2.20	4.00	107,937	1,101,662
DC9-15F	MCDONNELL DOUGLAS	JT8D-7B	P&W	26	0.70	2.20	4.00	22,278	227,381
DC9-30	MCDONNELL DOUGLAS	JT8D-17	P&W	26	0.70	2.20	4.00	722,285	8,425,544
DC9-40	MCDONNELL DOUGLAS	JT8D-15 (R.E.C	P&W	26	0.70	2.20	4.00	7,256	13,704
DC9-50	MCDONNELL DOUGLAS	JT8D-17	P&W	26	0.70	2.20	4.00	144,829	1,689,448
Total								5,014,135	52,581,730
				Conversion to Tons					**26,291**

Methodology:

Aircraft- Lead (1990)

The estimate for lead was taken from the National Air Pollutant Emission Trends, 1900-1996 document (U.S. EPA, 1997).

Reference

U.S. Environmental Protection Agency. 1997 (December). *National Air Pollutant Emission Trends, 1900-1996.* EPA-454/R-97-001. Office of Air Quality Planning and Standards. Research Triangle Park, NC.

Methodology:

Marine Vessels - 1990 Emissions: Acetaldehyde, Acrolein, Arsenic, Benzene, Beryllium, Cadmium, Chromium, Ethylbenzene, Formaldehyde, Lead, Manganese, Mercury, n-Hexane, Nickel, POM as 16-PAH, Propionaldehyde, Selenium, Styrene, Toluene, Xylene

1990 toxic emissions from marine vessels were calculated for distillate fuel oil and residual fuel oil using the Fuel Sales methodology described in *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (U.S. EPA, 1989).

First, the total 1990 national distillate fuel oil and residual fuel oil sales (in thousand gallons) were obtained from the *Fuel Oil and Kerosene Sales, 1990* report (U.S. DOE, 1991).

1990 National Fuel Oil Sales:
Distillate Fuel Oil 2,064,842 thousand gallons
Residual Fuel Oil 6,326,322 thousand gallons

Next, the gallons of fuel oil used in port were calculated. These calculations were based on the assumption that 75 percent of the distillate oil and 25 percent of the residual oil are used in port, which is also found in *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (U.S. EPA, 1989).

Distillate Fuel Oil 2,064,842 thousand gallons X 0.75 = 1,548,632 thousand gallons
Residual Fuel Oil 6,326,322 thousand gallons X 0.25 = 1,581,581 thousand gallons

Part 1: Distillate Fuel Oil

An emission factor was then applied to the gallons of distillate fuel oil used in port to calculate the volatile organic compounds (VOC) emissions. The emission factor was an average of the VOC emission factors for three motor vessel sizes found in *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (U.S. EPA, 1989); the average emission factor was 37.47 lb VOC/10^3 gallons.

1,548,632 thousand gallons X 37.47 lb VOC /10^3 gallons X 1 ton/2,000 lb = 29,014 tons VOC

Since emissions from marine vessels using distillate fuel oil are created by large diesel engines and marine vessel diesel speciation profiles have yet to be developed, the U.S. EPA assumed that the speciation profiles for heavy-duty diesel vehicles (HDDV) could also be used for marine vessels (Cook, 1999).

The speciation profiles were applied to the tons VOC emissions to estimate the toxic emissions from marine vessels. The HDDV speciation profiles were derived from information provided in “Evaluation of Factors That Affect Diesel Exhaust Toxicity” (Truex and Norbeck, 1998). An example of how the speciation profiles were derived is as follows:

2.14 acrolein weighted total (mg/Bhp-hr) / 604.91 (mg/Bhp-hr) VOC weighted total =
0.0035 acrolein/VOC

Table 1 contains the toxic emissions from marine vessels using distillate fuel oil.

Table 1: Marine Vessel Distillate Fuel Oil Emissions

Pollutant	Speciation Profiles (Pollutant/VOC)	Distillate Fuel Oil VOC Emissions (tons)	1990 Distillate Fuel Oil Toxic Emissions (tons)
Acrolein	0.0035	29,014	**101.55**
Styrene	0.0021	29,014	**60.93**

Methodology:

Part 2: Residual Fuel Oil

Emission factors for marine vessels using residual fuel oil were obtained from the U.S. EPA (Porter, 1998; and U.S. EPA, 1996) and converted from lb/MM Btu to lb/gallon using a conversion factor of 140,000 Btu/gallon. These conversion factors were applied directly to the gallons of residual fuel oil used in port (calculated above) to estimate the toxic emissions from marine vessels using residual fuel oil. These calculations can be found in Table 2.

Table 2: Marine Vessel Residual Fuel Oil Emissions

Pollutant	Emission Factor (tons/10^3 gallon)	Residual Fuel Oil Used in Port (thousand gallons)	1990 Residual Fuel Oil Toxic Emissions (tons)
Acetaldehyde	2.45 E-06	1,581,581	**3.87**
Benzene	1.05 E-07	1,581,581	**0.17**
Formaldehyde	1.68 E-05	1,581,581	**26.57**
POM as 16-PAH	5.88 E-07	1,581,581	**0.93**
Arsenic	6.58 E-07	1,581,581	**1.04**
Beryllium	1.40 E-08	1,581,581	**0.02**
Cadmium	1.96 E-07	1,581,581	**0.31**
Chromium	4.20 E-07	1,581,581	**0.66**
Lead	7.70 E-07	1,581,581	**1.22**
Manganese	1.47 E-06	1,581,581	**2.32**
Mercury	5.67 E-08	1,581,581	**0.09**
Nickel	4.20 E-05	1,581,581	**66.43**
Selenium	3.43 E-07	1,581,581	**0.54**

References

Cook, Rich. 1999 (February 24, 1999). E-mail to Teresa Kraus, Eastern Research Group, Inc. entitled, *Marine Vessel Methodology Reference - Reply*. U.S. Environmental Protection Agency, Office of Mobile Sources. Ann Arbor, MI.

Porter, Fred. 1998 (November 13, 1998). Note to Anne Pope, U.S. Environmental Protection Agency, Emission Factor and Inventory Group entitled, *Comments on Commercial/Institutional Heating Information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources – Interim Final Report, September 18, 1998."* U.S. Environmental Protection Agency, Emission Standards Division. Research Triangle Park, NC.

Truex, Dr. Timothy J. and Dr. Joseph M. Norbeck. March 16, 1998. *Evaluation of Factors That Affect Diesel Exhaust Toxicity*. University of California-Riverside, Center for Environmental Research and Technology. Riverside, CA.

U.S. Department of Energy. 1991 (October). DOE/EIA – 0535 (90), DE92 002003. *Fuel Oil and Kerosene Sales, 1990*. Energy Information Administration, Office of Oil and Gas. Washington, DC.

U.S. Environmental Protection Agency. 1996. *Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources*. Research Triangle Park, NC.

U.S. Environmental Protection Agency. 1989. *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*. Office of Air Quality Planning and Standards. Research Triangle Park, NC.

Methodology:

Locomotives - 1990 Emissions: Acrolein, Ethylbenzene, n-Hexane, Propionaldehyde, Styrene, Toluene, and Xylene

1990 toxic emissions from locomotives were calculated using the following steps.

First, the 1990 national distillate fuel oil sales (in gallons) were obtained from the *Fuel Oil and Kerosene Sales, 1990* report (U.S. DOE, 1991).

1990 Railroad Distillate Fuel Oil Sales: 3,104,630,000 gallons

Next, a hydrocarbon (HC) emission factor for locomotives was provided in *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (U.S. EPA, 1992). This emission factor was applied to the 1990 national distillate fuel oil sales (above) to give the pounds of HC emissions. The pounds of HC were converted to total tons HC by dividing the pounds by 2000 (lbs/ton).

3,104,630,000 gallons X 0.0211 lbs HC/gallon X 1 ton/2,000 lbs = 32,754 tons HC

The tons HC emissions were then converted to tons volatile organic compound (VOC) emissions by applying a conversion factor provided in *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources* (U.S. EPA, 1992).

32,754 tons HC X 1.005 VOC/HC = 32,918 tons VOC

Since locomotive emissions are created by large diesel engines and locomotive diesel speciation profiles have yet to be developed, the U.S. EPA assumed that the speciation profiles for heavy-duty diesel vehicles (HDDV) could also be used for locomotives (U.S. EPA, 1992). The HDDV speciation profiles were derived from information provided in "Evaluation of Factors That Affect Diesel Exhaust Toxicity" (Truex and Norbeck, 1998). An example of how the speciation profiles were derived is as follows:

2.14 acrolein weighted total (mg/Bhp-hr) / 604.91 (mg/Bhp-hr) VOC weighted total =
0.0035 acrolein/VOC

These speciation profiles were applied to the tons VOC emissions for each state to estimate the toxic emissions from locomotives. Table 1 displays the toxic emissions from locomotives.

Table 1: 1990 Locomotive Toxic Emissions

Pollutant	**Speciation Profiles (Pollutant/VOC)**	**Distillate Fuel Oil VOC Emissions (tons)**	**1990 Distillate Fuel Oil Toxic Emissions (tons)**
Acrolein	0.0035	32,918	**115.21**
Styrene	0.0021	32,918	**69.13**

References

Truex, Dr. Timothy J. and Dr. Joseph M. Norbeck. March 16, 1998. *Evaluation of Factors That Affect Diesel Exhaust Toxicity*. University of California-Riverside, Center for Environmental Research and Technology. Riverside, CA.

U.S. Department of Energy. 1991 (October). DOE/EIA – 0535 (90), DE92 002003. *Fuel Oil and Kerosene Sales, 1990.* Energy Information Administration, Office of Oil and Gas. Washington, DC.

U.S. Environmental Protection Agency. 1992. *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*. Office of Mobile Sources, Emission Planning and Strategies Division. Ann Arbor, Michigan.

Methodology:

Non-Road Vehicles and Equipment- 1,3-Butadiene, Acetaldehyde, Formaldehyde, and Styrene (1990)

Total 1990 emissions were calculated using the following steps. (These calculations can also be viewed in the spreadsheet below.)

Total 1990 volatile organic compound (VOC) emissions for non-road vehicles and equipment were provided in an E-mail from Rich Cook, U.S. Environmental Protection Agency (U.S. EPA)/Office of Mobile Sources (OMS) to Richard Billings and Teresa Kraus, Eastern Research Group, Inc., or ERG [Cook (c), 1998]. These nonroad gasoline and diesel engine VOC totals were draft nonroad VOC numbers for the 1998 Trends inventory (9/29/99 version).

Non-Road Gasoline Powered	1,754,000
Non-Road Diesel Powered	417,000

The non-road gasoline total was then weighted for 2- and 4-stroke engines based on information in an E-mail from Rich Cook, U.S. EPA/OMS, to Richard Billings, ERG [Cook (a), 1998]. The estimates provided in the E-mail were outputs from a draft version of the NONROAD model produced by the OMS.

2-stroke Engine Fraction = 52%
4-stroke Engine Fraction = 48%

Application of these percentages to the total non-road gasoline vehicle and equipment VOC total gives the following breakdown.

2-stroke Engine Fraction: 1,754,000 tons VOC X 0.52 = 912,080 tons VOC
4-stroke Engine Fraction: 1,754,000 tons VOC X 0.48 = 841,920 tons VOC

Exhaust and evaporative emission fractions were also provided in the E-mail from Rich Cook to Richard Billings [Cook (a), 1998]. Nonroad vehicles and equipment have no 1,3-butadiene, acetaldehyde, formaldehyde, or styrene evaporative emissions; therefore, evaporative emissions were not calculated. For 2-stroke engines, the exhaust fraction was 95%, and for 4-stroke engines, the exhaust fraction was 84%. These fractions were applied to the 2- and 4-stroke engine VOC values calculated above.

VOC Exhaust Emissions
2-Stroke Engines: 912,080 tons VOC X 0.95 = 866,476.00 tons VOC
4-Stroke Engines: 841,920 tons VOC X 0.84 = 707,212.80 tons VOC

Organic pollutant speciation profiles for 2-stroke, 4-stroke and diesel engines are provided below and were applied to the VOC values above.

Speciation Profiles
Part 4 of the spreadsheet below contains the pollutant/VOC fractions.

Exhaust Fractions
The 2-stroke, 4-stroke, and diesel engine exhaust pollutant/VOC fractions from the Albert Censullo reference, *Development of Species Profiles for Selected Organic Emission Sources* (reference 1 of Part 4 on the spreadsheet), were given as percent total organic gas (TOG). For each of the engines in this study, the percentages were averaged. Each average was then converted to VOCs using conversion factors provided in an E-mail from Rich Cook, U.S. EPA/OMS, to Richard Billings and Teresa Kraus, ERG, [Cook (b), 1998].

Methodology:

Example conversion calculation of %TOG to VOC for 2-Stroke Engines:
(0.26620 average 1,3-butadiene % TOG / 100) X 1.0000 VOC/TOG = 2.6620E-03 1,3-butadiene/VOC exhaust fraction
Example conversion calculation of %TOG to VOC for 4-Stroke Engines:
(1.3424 average 1,3-butadiene % TOG / 100) X 1.0912 VOC/TOG = 1.4648E-02 1,3-butadiene/VOC exhaust fraction

Example conversion calculation of %TOG to VOC for Diesel Engines:
(0.18983 average 1,3-butadiene % TOG / 100) X 1.0173 VOC/TOG = 1.8616E-03 1,3-butadiene/VOC exhaust fraction

Additionally, pollutant/VOC fractions for 2- and 4-stroke engines were provided in a memorandum from Rich Cook, U.S. EPA/OMS, to Anne Pope, U.S. EPA/OAQPS (Cook, 1997). The pollutant/VOC fractions from this reference can be found in the rows labeled, "VOC Fractions From Reference 2."

The exhaust pollutant/VOC fractions for 2- and 4-stroke engines provided by the references listed above were then combined using a weighted average based on the number of engines used in each study. (This was not done for the diesel engines; the pollutant/VOC fractions from the Censullo reference were the final fractions.)

The final exhaust pollutant/VOC fractions were then applied to the exhaust VOC total calculated above for non-road vehicles and equipment with 2-stroke, 4-stroke, and diesel engines.

The final nonroad vehicle and equipment 1,3-butadiene, acetaldehyde, formaldehyde, and styrene emissions were calculated by adding the exhaust totals from all of the engine types- 2-stroke, 4-stroke, and diesel engines. This can be found in Part 8 of the spreadsheet below.

References

Censullo, Albert C., Ph. D, California Polytechnic State University. *Development of Species Profiles for Selected Organic Emission Sources*. April 30, 1991.

Cook, Rich, U.S. EPA/Office of Mobile Sources (OMS) memorandum to Anne Pope U.S. EPA/Office of Air Quality Planning and Standards (OAQPS). " Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs." June 11, 1997.

Cook, Rich (a), U.S. EPA/OMS, E-mail to Richard Billings, Eastern Research Group, Inc. (ERG). "Nonroad NTI Estimates." October 5, 1998.

Cook, Rich (b), U.S. EPA/OMS, E-mail to Richard Billings and Teresa Kraus, ERG. "Re: nonroad- Reply-Reply." October 26, 1998.

Cook, Rich (c), U.S. EPA/OMS, E-mail to Richard Billings and Teresa Kraus, ERG. "Nonroad Vehicles and Equipment Emission Changes- Reply." October 14, 1998.

Methodology:

Non-Road Vehicles and Equipment- 1,3-Butadiene, Acetaldehyde, Formaldehyde, and Styrene (1990)

Part 1: 1990 Non-Road Vehicle and Equipment VOC Emissions

Vehicle Type	Gasoline Powered	Diesel Powered
VOC (tons/yr)	1,754,000	417,000

Part 2: Calculation of VOC Emission Totals by Engine Type

Engine Type	Gasoline Powered VOC Total	Engine Type Fraction	VOC Total by Engine Type
2-Stroke Engines	1,754,000	52%	912,080
4-Stroke Engines	1,754,000	48%	841,920

Part 3: Calculation of Gasoline Engine VOC Exhaust Emissions by Engine Type

Engine Type	VOC Total by Engine Type	Exhaust Component	1990 VOC Exhaust Emissions
2-Stroke Engines	912,080	95%	866,476.00
4-Stroke Engines	841,920	84%	707,212.80

Part 4: 2-Stroke, 4-Stroke, and Diesel Pollutant/VOC Fractions

Pollutant	1,3-Butadiene	Acetaldehyde	Formaldehyde	Styrene
2-Stroke Engines % TOG (Reference 1)	0.0000E+00	4.7300E-02	1.0100E-02	8.6560E-01
	3.2310E-01	7.7000E-01	1.5640E-01	0.0000E+00
	4.0730E-01	2.7900E-02	1.0100E-02	3.0010E-01
	4.6490E-01	2.7620E-01	5.9830E-01	0.0000E+00
	1.3570E-01	5.6300E-02	1.0930E-01	0.0000E+00
Average %TOG	2.6620E-01	2.3554E-01	1.7684E-01	2.3314E-01
2-Stroke Engine TOG to VOC Conversion (Reference 2):	2.6620E-03	2.3554E-03	1.7684E-03	2.3314E-03
VOC Fractions From Reference 2:	1.5000E-03	8.0000E-04	3.5000E-03	0.0000E+00
Final 2-Stroke Exhaust Pollutant/ VOC Fractions Used In Calculations:	**2.1456E-03**	**1.6641E-03**	**2.5380E-03**	**1.2952E-03**
4-Stroke Engines % TOG (Reference 1)	1.2605E+00	1.7230E-01	5.5600E-01	0.0000E+00
	1.5316E+00	1.4410E-01	3.1622E+00	5.0800E-01
	2.8171E+00	2.3920E-01	5.8400E-01	0.0000E+00
	1.3788E+00	1.7500E-01	8.2100E-01	0.0000E+00
	1.2842E+00	1.4080E-01	6.6140E-01	5.9430E-01
	1.3815E+00	4.3430E-01	2.4286E+00	0.0000E+00
	2.1380E-01	2.2100E-01	7.1890E-01	0.0000E+00
	8.7140E-01	1.0038E+00	1.5810E+00	0.0000E+00
Average %TOG	1.3424E+00	3.1631E-01	1.3141E+00	1.3779E-01
4-Stroke Engine TOG to VOC Conversion (Reference 2):	1.4648E-02	3.4516E-03	1.4340E-02	1.5035E-03
VOC Fractions From Reference 2:	7.9000E-03	4.5000E-03	1.0100E-02	3.0000E-04

Methodology:

Part 4 (Continued): 2-Stroke, 4-Stroke, and Diesel Pollutant/VOC Fractions

Pollutant	1,3-Butadiene	Acetaldehyde	Formaldehyde	Styrene
Final 4-Stroke Exhaust Pollutant/ VOC Fractions Used In Calculations:	**1.0471E-02**	**4.1006E-03**	**1.1715E-02**	**7.5849E-04**
Diesel Engines % TOG (Reference 1)	0.0000E+00	5.5769E+00	1.3861E+01	8.7700E-02
	0.0000E+00	5.9778E+00	1.5052E+01	0.0000E+00
	0.0000E+00	7.5917E+00	1.9066E+01	7.6900E-02
	1.4333E+00	3.3328E+00	6.7659E+00	0.0000E+00
	1.6400E-02	8.5927E+00	2.1792E+01	6.2300E-02
	2.0600E-02	1.1513E+01	1.6193E+01	3.3600E-02
	0.0000E+00	9.3346E+00	1.1839E+01	0.0000E+00
	4.8300E-02	6.5077E+00	1.3077E+01	2.0700E-01
Average %TOG	1.8983E-01	7.3034E+00	1.4706E+01	5.8438E-02
Diesel Engine TOG to VOC Conversion (Reference 2):	1.9311E-03	7.4298E-02	1.4960E-01	5.9448E-04
Final Diesel Pollutant/VOC Fractions Used In Calculations:	**1.9311E-03**	**7.4298E-02**	**1.4960E-01**	**5.9448E-04**

References:

1. Censullo, Albert C., Ph. D, California Polytechnic State University. Development of Species Profiles for Selected Organic Emission Sources. April 30, 1991.
2. Memorandum from Rich Cook, U.S. EPA/Office of Mobile Sources (OMS) to Anne Pope U.S. EPA/Office of Air Quality Planning and Standards (OAQPS). " Source Identification and base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs." June 11, 1997.
3. Memorandum from Rich Cook, U.S. EPA/OMS, to Laurel Driver and Anne Pope, U.S. EPA/OAQPS. "Guidance on Mobile Source Emission Estimates in the 1996 National Toxics Invenory."
4. Gabele, Peter, U.S. EPA. Exhaust Emissions from Four-Stroke Lawn Mower Engines. Journal of the Air & Waste Mangement Association, Volume 47, pp. 945-950. September 1997.

Part 5: Calculation of 2-Stroke Exhaust Emissions

Pollutant	1,3-Butadiene	Acetaldehyde	Formaldehyde	Styrene
2-Stroke Engine Exhaust VOC Emissions	866,476	866,476	866,476	866,476
2-Stroke Engine Exhaust Pollutant/VOC Fraction	2.1456E-03	1.6641E-03	2.5380E-03	1.2952E-03
2-Stroke Exhaust Emissions	**1,859.07**	**1,441.91**	**2,199.12**	**1,122.28**

Part 6: Calculation of 4-Stroke Exhaust Emissions

Pollutant	1,3-Butadiene	Acetaldehyde	Formaldehyde	Styrene
4-Stroke Engine Exhaust VOC Emissions	707,212.80	707,212.80	707,212.80	707,212.80
4-Stroke Engine Exhaust Pollutant/VOC Fraction	1.0471E-02	4.1006E-03	1.1715E-02	7.5849E-04
4-Stroke Exhaust Emissions	**7,404.95**	**2,900.00**	**8,285.13**	**536.41**

Methodology:

Part 7: Calculation of Diesel Exhaust Emissions

Pollutant	1,3-Butadiene	Acetaldehyde	Formaldehyde	Styrene
Diesel Engine Exhaust VOC Emissions	417,000	417,000	417,000	417,000
Diesel Engine Exhaust Pollutant/VOC Fraction	1.93E-03	7.43E-02	1.50E-01	5.94E-04
Diesel Exhaust Emissions	**805.26**	**30,982.21**	**62,383.81**	**247.9**

Part 8: Total 1990 Non-Road Vehicle and Equipment Toxic Emissions

Pollutant	1,3-Butadiene	Acetaldehyde	Formaldehyde	Styrene
2-Stroke Exhaust Emissions	1,859.07	1,441.91	2,199.12	1,122.28
4-Stroke Exhaust Emissions	7,404.95	2,900.00	8,285.13	536.41
Diesel Emissions	805.26	30,982.21	62,383.81	247.90
Total 1990 Emissions	**10,069.28**	**35,324.12**	**72,868.06**	**1,906.59**

Methodology:

Non-Road Vehicles and Equipment- Acrolein (1990)

Total 1990 emissions were calculated using the following steps. (These calculations can also be viewed in the spreadsheet below.)

Total 1990 volatile organic compound (VOC) emissions for non-road vehicles and equipment were provided in an E-mail from Rich Cook, U.S. Environmental Protection Agency (U.S. EPA)/Office of Mobile Sources (OMS) to Richard Billings and Teresa Kraus, Eastern Research Group, Inc. (ERG) [Cook (a), 1998]. These nonroad gasoline and diesel engine VOC totals were draft nonroad VOC numbers for the 1998 Trends inventory (9/29/99 version).

The non-road gasoline total was then weighted for 2- and 4-stroke engines based on information in an E-mail from Rich Cook, U.S. EPA/OMS, to Richard Billings, ERG [Cook (b), 1998]. The estimates provided in the E-mail were outputs from a draft version of the NONROAD model produced by the OMS.

Exhaust and evaporative emission fractions were also provided in the E-mail from Rich Cook to Richard Billings [Cook (b), 1998]. Nonroad vehicles and equipment have no acrolein evaporative emissions; therefore, evaporative emissions were not calculated. For 2-stroke engines, the exhaust fraction was 95%, and for 4-stroke engines, the exhaust fraction was 84%. These fractions were applied to the 2- and 4-stroke engine VOC values.

Acrolein/VOC speciation profiles for 2-stroke, 4-stroke and diesel engines were provided in a memorandum from Rich Cook, U.S. EPA/OMS, to Anne Pope, U.S. EPA/OAQPS (Cook, 1997), and were applied to the VOC values above.

The final nonroad vehicle and equipment acrolein emissions were calculated by adding the exhaust totals from all of the engine types- 2-stroke, 4-stroke, and diesel engines. This can be found in Part 8 of the spreadsheet below.

References

Cook, Rich, U.S. EPA/Office of Mobile Sources (OMS) memorandum to Anne Pope U.S. EPA/Office of Air Quality Planning and Standards (OAQPS). " Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs." June 11, 1997.

Cook, Rich (a), U.S. EPA/OMS, E-mail to Richard Billings and Teresa Kraus, ERG. "Nonroad Vehicles and Equipment Emission Changes- Reply." October 14, 1998.

Cook, Rich (b), U.S. EPA/OMS, E-mail to Richard Billings, Eastern Research Group, Inc. (ERG). "Nonroad NTI Estimates." October 5, 1998.

Methodology:

Non-Road Vehicles and Equipment- Acrolein (1990)

Part 1: 1990 Non-Road Vehicle and Equipment VOC Emissions[1]

Vehicle Type	Gasoline Powered	Diesel Powered
VOC (tons/yr)	1,754,000	417,000

Part 2: Calculation of VOC Emission Totals by Engine Type[2]

Engine Type	Gasoline Powered VOC Total	Engine Type Fraction	VOC Total by Engine Type
2-Stroke Engines	1,754,000	52%	912,080.00
4-Stroke Engines	1,754,000	48%	841,920.00

Part 3: Calculation of Gasoline Engine VOC Exhaust Emissions by Engine Type[2]

Engine Type	VOC Total by Engine Type	Exhaust Component	1990 VOC Exhaust Emissions
2-Stroke Engines	912,080	95%	866,476.00
4-Stroke Engines	841,920	84%	707,212.80

Part 4: 2-Stroke, 4-Stroke, and Diesel Pollutant/VOC Fractions[3]

Engine Type	Acrolein
2-Stroke	0.0003
4-Stroke	0.0007
Diesel	0.0115

Part 5: Calculation of 2-Stroke Exhaust Emissions

Pollutant	Acrolein
2-Stroke Engine Exhaust VOC Emissions	866,476.00
2-Stroke Engine Exhaust Pollutant/VOC Fraction	0.0003
2-Stroke Exhaust Emissions	**259.94**

Part 6: Calculation of 4-Stroke Exhaust Emissions

Pollutant	Acrolein
4-Stroke Engine Exhaust VOC Emissions	707,212.80
4-Stroke Engine Exhaust Pollutant/VOC Fraction	0.0007
4-Stroke Exhaust Emissions	**495.05**

Part 7: Calculation of Diesel Exhaust Emissions

Pollutant	Acrolein
Diesel Engine Exhaust VOC Emissions	417,000
Diesel Engine Exhaust Pollutant/VOC Fraction	0.0115
Diesel Exhaust Emissions	**4,795.50**

Part 8: Total 1990 Non-Road Vehicle and Equipment Toxic Emissions

Pollutant	Acrolein
2-Stroke Exhaust Emissions	259.94
4-Stroke Exhaust Emissions	495.05
Diesel Emissions	4,795.50
Total 1990 Emissions	**5,550.49**

1: Cook, Rich (a), U.S. EPA/OMS, E-mail to Richard Billings and Teresa Kraus, ERG. "Nonroad Vehicles and Equipment Emission Changes- Reply." October 14, 1998.

2: Cook, Rich (b), U.S. EPA/OMS, E-mail to Richard Billings, Eastern Research Group, Inc. (ERG). "Nonroad NTI Estimates." October 5, 1998.

3: Cook, Rich, U.S. EPA/Office of Mobile Sources (OMS) memorandum to Anne Pope U.S. EPA/Office of Air Quality Planning and Standards (OAQPS). "Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs." June 11, 1997.

Methodology:

Non-Road Vehicles and Equipment- Benzene (1990)

Total 1990 emissions were calculated using the following steps. (These calculations can also be viewed in the spreadsheet below.)

Total 1990 volatile organic compound (VOC) emissions for non-road vehicles and equipment were provided in an E-mail from Rich Cook, U.S. Environmental Protection Agency (U.S. EPA)/Office of Mobile Sources (OMS) to Richard Billings and Teresa Kraus, Eastern Research Group, Inc., or ERG [Cook (c), 1998]. These nonroad gasoline and diesel engine VOC totals were draft nonroad VOC numbers for the 1998 Trends inventory (9/29/99 version).

Non-Road Gasoline Powered	1,754,000
Non-Road Diesel Powered	417,000

The non-road gasoline total was then weighted for 2- and 4-stroke engines based on information in an E-mail from Rich Cook, U.S. EPA/OMS, to Richard Billings, ERG [Cook (a), 1998]. The estimates provided in the E-mail were outputs from a draft version of the NONROAD model produced by the OMS.

2-stroke Engine Fraction = 52%
4-stroke Engine Fraction = 48%

Application of these percentages to the total non-road gasoline vehicle and equipment VOC total gives the following breakdown.

2-stroke Engine Fraction: 1,754,000 tons VOC X 0.52 = 912,080 tons VOC
4-stroke Engine Fraction: 1,754,000 tons VOC X 0.48 = 841,920 tons VOC

Exhaust and evaporative emission fractions were also provided in the E-mail from Rich Cook to Richard Billings [Cook (a), 1998]. For 2-stroke engines, the exhaust fraction was 95%, and the evaporative fraction was 5%. For 4-stroke engines, the exhaust fraction was 84%, and the evaporative fraction was 16%. These fractions were applied to the 2- and 4-stroke engine VOC values calculated above.

VOC Exhaust Emissions
2-Stroke Engines: 912,080 tons VOC X 0.95 = 866,476.00 tons VOC
4-Stroke Engines: 841,920 tons VOC X 0.84 = 707,212.80 tons VOC

VOC Evaporative Emissions
2-Stroke Engines: 912,080 tons VOC X 0.05 = 45,604.00 tons VOC
4-Stroke Engines: 841,920 tons VOC X 0.16 = 134,707.20 tons VOC

Organic pollutant speciation profiles for 2-stroke, 4-stroke and diesel engines are provided below and were applied to the VOC values above.

Speciation Profiles
Part 5 of the spreadsheet below contains the pollutant/VOC fractions.

1. Exhaust Fractions
The 2-stroke, 4-stroke, and diesel engine exhaust pollutant/VOC fractions from the Albert Censullo reference, *Development of Species Profiles for Selected Organic Emission Sources* (reference 1 of Part 5 on the spreadsheet), were given as percent total organic gas (TOG). For each of the engines in this study, the percentages were averaged. Each average was then converted to VOCs using conversion factors provided in an E-mail from Rich Cook, U.S. EPA/OMS, to Richard Billings and Teresa Kraus, ERG, [Cook (b), 1998].

Methodology:

Example conversion calculation of %TOG to VOC for 2-Stroke Engines:
(3.5685 average benzene % TOG / 100) X 1.0000 VOC/TOG = 3.5685E-02 benzene/VOC exhaust fraction
Example conversion calculation of %TOG to VOC for 4-Stroke Engines:
(5.3390 average benzene % TOG / 100) X 1.0912 VOC/TOG = 5.8259E-02 benzene/VOC exhaust fraction

Example conversion calculation of %TOG to VOC for Diesel Engines:
(1.9999 average benzene % TOG / 100) X 1.0173 VOC/TOG = 2.0344E-02 benzene/VOC exhaust fraction

Additionally, pollutant/VOC fractions for 2- and 4-stroke engines were provided in a memorandum from Rich Cook, U.S. EPA/OMS, to Anne Pope, U.S. EPA/OAQPS (Cook, 1997). The pollutant/VOC fractions from this reference can be found in the rows labeled, "VOC Fractions From Reference 2."

The exhaust pollutant/VOC fractions for 2- and 4-stroke engines provided by the references listed above were then combined using a weighted average based on the number of engines used in each study. (This was not done for the diesel engines; the pollutant/VOC fractions from the Censullo reference were the final fractions.)

The final exhaust pollutant/VOC fractions were then applied to the exhaust VOC total calculated above for non-road vehicles and equipment with 2-stroke, 4-stroke, and diesel engines.

1. Evaporative Fractions

Evaporative pollutant/VOC fractions for benzene emissions from 2- and 4-stroke engines were provided in a memorandum from Rich Cook, U.S. EPA/OMS, to Anne Pope, U.S. EPA/OAQPS (Cook, 1997). The evaporative pollutant/VOC fraction was applied to the evaporative VOC total calculated above for non-road vehicles and equipment with 2- and 4-stroke engines.

The final nonroad vehicle and equipment benzene emissions were calculated by adding the exhaust and evaporative totals from all of the engine types- 2-stroke, 4-stroke, and diesel engines. This can be found in Part 12 of the spreadsheet below.

References

Censullo, Albert C., Ph. D, California Polytechnic State University. *Development of Species Profiles for Selected Organic Emission Sources*. April 30, 1991.

Cook, Rich, U.S. EPA/Office of Mobile Sources (OMS) memorandum to Anne Pope U.S. EPA/Office of Air Quality Planning and Standards (OAQPS). " Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs." June 11, 1997.

Cook, Rich (a), U.S. EPA/OMS, E-mail to Richard Billings, Eastern Research Group, Inc. (ERG). "Nonroad NTI Estimates." October 5, 1998.

Cook, Rich (b), U.S. EPA/OMS, E-mail to Richard Billings and Teresa Kraus, ERG. "Re: nonroad- Reply-Reply." October 26, 1998.

Cook, Rich (c), U.S. EPA/OMS, E-mail to Richard Billings and Teresa Kraus, ERG. "Nonroad Vehicles and Equipment Emission Changes- Reply." October 14, 1998.

U.S. EPA. TOC/PM Speciation Data System, Version 2.03. Research Triangle Park, North Carolina. May 1995.

Methodology:

Non-Road Vehicles and Equipment- Benzene (1990)

Part 1: 1990 Non-Road Vehicle and Equipment VOC Emissions

Vehicle Type	Gasoline Powered	Diesel Powered
VOC (tons/yr)	1,754,000	417,000

Part 2: Calculation of VOC Emission Totals by Engine Type

Engine Type	Gasoline Powered VOC Total	Engine Type Fraction	VOC Total by Engine Type
2-Stroke Engines	1,754,000	52%	912,080
4-Stroke Engines	1,754,000	48%	841,920

Part 3: Calculation of Gasoline Engine VOC Exhaust Emissions by Engine Type

Engine Type	VOC Total by Engine Type	Exhaust Component	1990 VOC Exhaust Emissions
2-Stroke Engines	912,080	95%	866,476.00
4-Stroke Engines	841,920	84%	707,212.80

Part 4: Calculation of Gasoline Engine VOC Evaporative Emissions by Engine Type

Engine Type	VOC Total by Engine Type	Exhaust Component	1990 VOC Exhaust Emissions
2-Stroke Engines	912,080	5%	45,604.00
4-Stroke Engines	841,920	16%	134,707.20

Part 5: 2-Stroke, 4-Stroke, and Diesel Pollutant/VOC Fractions

Pollutant	Benzene
2-Stroke Engines % TOG (Reference 1)	4.6134E+00
	3.5433E+00
	3.8729E+00
	3.3129E+00
	2.4998E+00
Average %TOG	3.5685E+00
2-Stroke Engine TOG to VOC Conversion (Reference 2):	3.5685E-02
VOC Fractions From Reference 2:	1.2000E-02
Final 2-Stroke Exhaust Pollutant/ VOC Fractions Used In Calculations:	**2.5158E-02**

Methodology:

Part 5 (Continued): 2-Stroke, 4-Stroke, and Diesel Pollutant/VOC Fractions

Pollutant	Benzene
4-Stroke Engines % TOG (Reference 1)	7.5099E+00
	5.2688E+00
	3.9106E+00
	4.8613E+00
	4.1764E+00
	4.4417E+00
	7.2653E+00
	5.2782E+00
Average %TOG	5.3390E+00
4-Stroke Engine TOG to VOC Conversion (Reference 2):	5.8259E-02
VOC Fractions From Reference 2:	4.8900E-02
VOC Fractions From Reference 4:	Already included in Reference 2
Final 4-Stroke Exhaust Pollutant/ VOC Fractions Used In Calculations:	**5.2466E-02**
Diesel Engines % TOG (Reference 1)	1.0546E+00
	1.4391E+00
	1.7424E+00
	6.2867E+00
	1.4855E+00
	1.2672E+00
	9.9480E-01
	1.7285E+00
Average %TOG	1.9999E+00
Diesel Engine TOG to VOC Conversion (Reference 2):	2.0344E-02
Final Diesel Pollutant/VOC Fractions Used In Calculations:	**2.0344E-02**

References:

1. Censullo, Albert C., Ph. D, California Polytechnic State University. Development of Species Profiles for Selected Organic Emission Sources. April 30, 1991.

2. Memorandum from Rich Cook, U.S. EPA/Office of Mobile Sources (OMS) to Anne Pope U.S. EPA/Office of Air Quality Planning and Standards (OAQPS). " Source Identification and base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs." June 11, 1997.

3. Memorandum from Rich Cook, U.S. EPA/OMS, to Laurel Driver and Anne Pope, U.S. EPA/OAQPS. "Guidance on Mobile Source Emission Estimates in the 1996 National Toxics Invenory."

Part 6: Evaporative Emission Pollutant/VOC Fractions

Pollutant	Benzene
2- and 4-Stroke Engine Evaporative Pollutant/ VOC Fraction	2.2000E-02

Methodology:

Part 7: Calculation of 2-Stroke Exhaust Emissions

Pollutant	Benzene
2-Stroke Engine Exhaust VOC Emissions	866,476.00
2-Stroke Engine Exhaust Pollutant/VOC Fraction	2.5158E-02
2-Stroke Exhaust Emissions	**21,798.90**

Part 8: Calculation of 2-Stroke Evaporative Emissions

Pollutant	Benzene
2-Stroke Engine Evaporative VOC Emissions	45,604.00
2-Stroke Engine Evaporative Pollutant/VOC Fraction	2.2000E-02
2-Stroke Evaporative Emissions	**1,003.29**

Part 9: Calculation of 4-Stroke Exhaust Emissions

Pollutant	Benzene
4-Stroke Engine Exhaust VOC Emissions	707,212.80
4-Stroke Engine Exhaust Pollutant/VOC Fraction	5.2466E-02
4-Stroke Exhaust Emissions	**37,104.27**

Part 10: Calculation of 4-Stroke Evaporative Emissions

Pollutant	Benzene
4-Stroke Engine Evaporative VOC Emissions	134,707
4-Stroke Engine Evaporative Pollutant/VOC Fraction	2.2000E-02
4-Stroke Evaporative Emissions	**2,963.56**

Part 11: Calculation of Diesel Exhaust Emissions

Pollutant	Benzene
Diesel Engine Exhaust VOC Emissions	417,000
Diesel Engine Exhaust Pollutant/VOC Fraction	2.0344E-02
Diesel Exhaust Emissions	**8,483.65**

Part 12: Total 1990 Non-Road Vehicle and Equipment Toxic Emissions

Pollutant	Benzene
2-Stroke Exhaust Emissions	21,798.90
2-Stroke Evaporative Emissions	1,003.29
4-Stroke Exhaust Emissions	37,104.27
4-Stroke Evaporative Emissions	2,963.56
Diesel Emissions	8,483.65
Total 1990 Emissions	**71,353.67**

Methodology:

Non-Road Vehicles and Equipment- Chromium, Manganese, Mercury, and Nickel (1990)

To calculate the 1990 chromium, manganese, mercury, and nickel emissions estimates, speciation profiles were applied to 1990 national emissions estimates of non-road gasoline and diesel engine particulate matter less than 10 microns in size (PM10). The 1990 national PM10 emissions for non-road vehicles and equipment were provided in an E-mail from Rich Cook, U.S. EPA/OMS, to Richard Billings and Teresa Kraus, Eastern Research Group, Inc (Cook, 1998). These PM10 emissions were draft nonroad PM10 numbers used in the 1998 Trends inventory (9/29/99 version).

Non-Road Gasoline = 48,000 tons PM10
Non-Road Diesel = 318,000 tons PM10

Based on recommendations in a memorandum from Rich Cook, U.S. Environmental Protection Agency (U.S. EPA)/Office of Mobile Sources (OMS), to Anne Pope, U.S. EPA/Office of Air Quality Planning and Standards, or OAQPS, (Cook, 1997), on-road gasoline and diesel vehicle speciation profiles were used as surrogates for non-road engines, because no speciation data for the metallic pollutants were available for non-road engines. The speciation profiles for on-road gasoline and diesel vehicles were applied to the PM10 emissions above. The gasoline engine group included light-duty gasoline vehicles (LDGVs), motorcycles (MCs), light-duty gasoline trucks 1 and 2 (LDGTs) and heavy-duty gasoline vehicles. The diesel engine group consisted of heavy-duty diesel vehicles (HDDVs). These speciation profiles can be found in Part 2 of the spreadsheet below.

The calculations of the gasoline and diesel emission estimates can be found in Parts 3 and 4 of the spreadsheet below. The following example calculation was repeated for each of the metals:

Chromium from Gasoline Engines
48,000 tons PM X 0.00006 chromium fraction (from Table 1) = 2.88 tons chromium
Chromium from Diesel Engines
318,000 tons PM X 0.00007 chromium fraction = 22.26 tons chromium

Total Chromium Emissions
2.88 tons chromium from gasoline engines + 22.26 tons chromium from diesel engines = 25.14 tons chromium

References

Cook, Rich, U.S. EPA/Office of Mobile Sources (OMS), memorandum to Anne Pope U.S. EPA/Office of Air Quality Planning and Standards (OAQPS). " Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs." June 11, 1997.

Cook, Rich, U.S. EPA/Office of Mobile Sources (OMS), E-mail to Richard Billings and Teresa Kraus, Eastern Research Group, Inc. "Nonroad Vehicles and Equipment Emission Changes- Reply." October 14, 1998.

Methodology:

Non-Road Vehicles and Equipment- Chromium, Manganese, Mercury, and Nickel (1990)

Part 1: 1990 PM10 Emissions

Engine Type	Gasoline Engines	Diesel Engines
PM10 (tons/yr)	48,000	318,000

Part 2: Gasoline and Diesel Speciation Profiles for On-Road Vehicles

Pollutant	Gasoline Vehicles	Diesel Engines
Chromium	0.00006	0.00007
Manganese	0.00012	0.00007
Mercury	0.00001	0.00002
Nickel	0.00007	0.00003

Part 3: 1990 Metal Emissions from Non-Road Gasoline Engines

Pollutant	1990 Gasoline Engine PM Emissions	Speciation Profile	Total Gasoline Engine Emissions
Chromium	48,000	0.00006	2.88
Manganese	48,000	0.00012	5.76
Mercury	48,000	0.00001	0.48
Nickel	48,000	0.00007	3.36

Part 4: 1990 Metal Emissions from Non-Road Diesel Engines

Pollutant	1990 Diesel Engine PM Emissions	Speciation Profile	Total Diesel Engine Emissions
Chromium	318,000	0.00007	22.26
Manganese	318,000	0.00007	22.26
Mercury	318,000	0.00002	6.36
Nickel	318,000	0.00003	9.54

Part 5: 1990 Total Metallic Pollutant Emissions from Non-Road Vehicles and Equipment

Pollutant	Total Gasoline Engine Emissions	Total Diesel Engine Emissions	**1990 Total Emissions**
Chromium	2.88	22.26	**25.14**
Manganese	5.76	22.26	**28.02**
Mercury	0.48	6.36	**6.84**
Nickel	3.36	9.54	**12.90**

Methodology:

Non-Road Vehicles and Equipment- Lead (1990)

The 1990 national estimate for lead was provided in the National Air Pollutant Emission Trends, 1900-1996 report (U.S. EPA/OAQPS, 1997).

Reference

U.S. Environmental Protection Agency (U.S. EPA)/Office of Air Quality Planning and Standards (OAQPS). National Air Pollutant Emission Trends, 1900-1996. EPA-454/R-97-011. December 1997.

Methodology:

Non-Road Vehicles and Equipment- POM as 16-PAH and POM as 7-PAH (1990)

The estimates for POM as 16-PAH and 7-PAH were calculated by applying speciation profiles to the 1990 national nonroad vehicle and equipment volatile organic compound (VOC) emissions.

Total 1990 VOC emissions for nonroad vehicles and equipment were provided in an E-mail from Rich Cook, U.S. EPA/OMS, to Richard Billings and Teresa Kraus, Eastern Research Group, Inc., or ERG [Cook (b), 1998]. These VOC emissions were draft nonroad VOC numbers used in the 1998 Trends inventory (9/29/99 version).

Non-Road Gasoline Powered = 1,754,000
Non-Road Diesel Powered = 417,000

The non-road gasoline total was then weighted for 2- and 4-stroke engines based on information in an E-mail from Rich Cook, U.S. EPA/OMS, to Richard Billings, ERG, October 5, 1998. The estimates provided in the E-mail were outputs from a draft version of the NONROAD model produced by the OMS.

2-stroke Engine Fraction = 52%
4-stroke Engine Fraction = 48%

Application of these percentages to the total non-road gasoline vehicle and equipment VOC total gives the following breakdown.

2-stroke Engine Fraction: 1,754,000 tons VOC X 0.52 = 912,080 tons VOC
4-stroke Engine Fraction: 1,754,000 tons VOC X 0.48 = 841,920 tons VOC

Exhaust and evaporative emission fractions were also provided in the E-mail from Rich Cook to Richard Billings [Cook (a), 1998]. For 2-stroke engines, the exhaust fraction was 95%, and the evaporative fraction was 5%. For 4-stroke engines, the exhaust fraction was 84%, and the evaporative fraction was 16%. These fractions were applied to the 2- and 4-stroke engine VOC values calculated above. Nonroad vehicles and equipment have no acrolein evaporative emissions; therefore, the evaporative percentages were not calculated.

VOC Exhaust Emissions
2-Stroke Engines: 912,080 tons VOC X 0.95 = 866,476 tons VOC
4-Stroke Engines: 841,920 tons VOC X 0.84 = 707,213 tons VOC

Speciation profiles for POM as 16- and 7-PAH were provided in a memorandum from Rich Cook, U.S. Environmental Protection Agency (U.S. EPA)/Office of Mobile Sources (OMS), to Anne Pope, U.S. EPA/Office of Air Quality Planning and Standards (Cook, 1997). These profiles were applied to the 2-stroke, 4-stroke, and diesel VOC exhaust emissions above.

POM as 16-PAH
2-Stroke Engines: 866,476 tons VOC X 1.66E-05 POM as 16-PAH/VOC = 14.38 tons POM as 16-PAH
4-Stroke Engines: 707,213 tons VOC X 1.51E-05 POM as 16-PAH/VOC = 10.68 tons POM as 16-PAH
Diesel Engines: 417,000 tons VOC X 6.27E-06 POM as 16-PAH/VOC = 2.61 tons POM as 16-PAH
Total POM as 16-PAH: 14.38 tons POM as 16-PAH from 2-stroke engines + 10.68 tons POM as 16-PAH from 4-stroke engines + 2.61 tons POM as 16-PAH from diesel engines = **27.67 tons POM as 16-PAH**

POM as 7-PAH
2-Stroke Engines: 866,476 tons VOC X 8.61E-06 POM as 7-PAH/VOC = 7.46 tons POM as 7-PAH
4-Stroke Engines: 707,213 tons VOC X 7.84E-06 POM as 7-PAH/VOC = 5.54 tons POM as 7-PAH
Diesel Engines: 438,000 tons VOC X 1.79E-06 POM as 7-PAH/VOC = 0.75 tons POM as 7-PAH
Total POM as 7-PAH: 7.46 tons POM as 7-PAH from 2-stroke engines + 5.54 tons POM as 7-PAH from 4-stroke engines + 0.75 tons POM as 7-PAH from diesel engines = **13.75 tons POM as 7-PAH**

Methodology:

Reference

Cook, Rich, U.S. EPA/Office of Mobile Sources (OMS), memorandum to Anne Pope U.S. EPA/Office of Air Quality Planning and Standards (OAQPS). " Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs." June 11, 1997.

Cook, Rich (a), U.S. EPA/OMS, E-mail to Richard Billings, Eastern Research Group, Inc. (ERG). "Nonroad NTI Estimates." October 5, 1998.

Cook, Rich (b), U.S. EPA/OMS, E-mail to Richard Billings and Teresa Kraus, Eastern Research Group, Inc. "Nonroad Vehicles and Equipment Emission Changes- Reply." October 14, 1998.

Methodology:

Onroad vehicle mobile source estimates were calculated based on two general approaches that either relied on speciation data or emission factors [vehicle miles traveled (VMT)-based]. The approach most commonly used in this inventory was the speciation approach. For dioxins/furans and lead, however, estimates were taken directly from existing sources. A summary of the onroad emission estimates are below.

Dioxins/Furans as 2,3,7,8-TCDD TEQ and Lead Estimates
The estimate for dioxins/furans as 2,3,7,8-TCDD TEQ is from the 112(c)(6) report.[1] The estimate for lead is from the TRENDS report.[2]

The following pollutants were calculated using speciation data.

Arsenic Estimates
Gasoline Vehicles:
In the TOC/PM Speciation Data System, Version 2.03, there are arsenic speciation profiles for particulate matter less than 10 microns (PM10) for light-duty gasoline vehicles (LDGVs) using leaded gasoline and diesel fuel.[3]

For the leaded fuels, the three speciation profiles provided were averaged to get the emission factor used.

(0.009 % + 0.133 % + 0.009 %) / 3 = 0.05 % of PM10 is arsenic

It was documented in an E-mail from Rich Cook, U.S. Environmental Protection Agency (U.S. EPA)/Office of Mobile Sources (OMS), that 4.8 percent of fuel consumed for on-road vehicles in 1990 was leaded.[4] This percentage was applied to the PM10 emission estimate in the National Emission Trends Viewer, Version 2.0 for LDGVs to approximate the amount of PM10 emitted by light-duty vehicles that could be attributed to vehicles using leaded fuels.[5]

60,956 tons X 0.048 = 2,925.89 tons of PM10 associated with use of leaded fuels in LDGVs

The average of arsenic emission factors for light-duty vehicles using leaded gasoline was applied to the estimate of PM10 attributed to light-duty vehicles using leaded fuel to get the arsenic estimate for this source category.

2,925.89 tons PM10 X 0.0005 arsenic/PM10 = **1.46 tons arsenic**

Diesel Vehicles:
Light-Duty Diesel Vehicles (LDDVs) and Light-Duty Diesel Trucks (LDDTs)
The single speciation profile, 32103, from the TOC/PM Speciation Data System, Version 2.03,[3] for light-duty vehicles that use diesel fuel was applied to the estimate of PM10 for LDDVs and LDDTs as reported in the National Emission Trends Viewer, Version 2.0 to get the arsenic estimate for light-duty diesel vehicles.[5]

10,752 tons PM10 X 0.00002 arsenic/PM10 = **0.22 tons arsenic**

Heavy-Duty Diesel Vehicles (HDDVs)
For HDDVs, an arsenic/PM10 fraction derived from information provided in the Truex and Norbeck reference[6] was applied to the total HDDV PM10 estimate reported in the National Emission Trends Viewer, Version 2.0.[5]

224,113 tons PM10 X 0.000000357 tons arsenic/tons PM10 = **0.08 tons arsenic**

Total 1990 Arsenic Emissions

Gasoline Vehicles	LDDVs + LDDTs	HDDVs	**Total**
1.46 tons	0.22 tons	0.08 tons	**1.76 tons**

Methodology:

Acrolein and Styrene Estimates
Total 1990 acrolein and styrene emissions were calculated as follows:

Total 1990 volatile organic compound (VOC) emissions for on-road gasoline and diesel vehicles (separated by vehicle type) were obtained from the National Emission Trends Viewer, Version 2.0.[5] The VOC estimates were converted to TOG using VOC/TOG factors obtained in the memorandum from Rich Cook to Anne Pope.[7] Total TOG estimates were then apportioned to exhaust and evaporative sources using exhaust fractions derived from this memorandum.[7] The exhaust and evaporative TOG estimates were applied to appropriate speciation profiles noted in the following tables. There were no speciation profiles available for acrolein and styrene evaporative emissions; therefore, neither acrolein nor styrene evaporative emissions were calculated.

Acrolein Speciation Profiles

Source Type	Profile	Reference
Exhaust for LDGVs + MCs and LDDTs	0.0006 tons Acrolein/ tons TOG	3
Exhaust for HDGV	0.0044 tons Acrolein/ tons TOG	7
Exhaust for diesel vehicles (LDDVs, LDDTs, and HDDVs)*	0.0035 tons Acrolein/ tons VOC	6

*The speciation profile for HDDVs was used as a surrogate for LDDVs and LDDTs as no separate profiles were available for the latter vehicle types. The HDDV exhaust fraction is calculated below.

2.14 acrolein weighted total (mg/Bhp-hr) / 604.91 (mg/Bhp-hr) VOC weighted total = 0.0035 acrolein VOC fraction

This fraction was multiplied by the 1990 diesel vehicle VOC fraction to obtain the total acrolein emissions from diesel vehicles.

Styrene Speciation Profiles

Source Type	Profile	Reference
Exhaust for LDGVs + MCs and LDGTs	0.0034 tons Styrene/ tons TOG	7
Exhaust HDGVs	0.0000 tons Styrene/ tons TOG	7
Exhaust for diesel vehicles (LDDVs, LDDTs, and HDDVs)*	0.0021 tons Styrene/ tons VOC	6

*The speciation profile for HDDVs was used as a surrogate for LDDVs and LDDTs as no separate profiles were available for the latter vehicle types. The HDDV exhaust fraction is calculated below.

1.27 styrene weighted total (mg/Bhp-hr) / 604.91 (mg/Bhp-hr) VOC weighted total = 0.0021 styrene VOC fraction

This fraction was multiplied by the 1990 diesel vehicle VOC fraction to obtain the total styrene emissions from diesel vehicles.

The total 1990 acrolein and styrene on-road vehicle emissions were calculated by summing the total gasoline vehicle emissions (excluding HDGVs), HDGVs, and total diesel vehicle emissions. Table 1, below, contains more detailed calculations.

The following pollutants were calculated using VMT data. 1990 VMT data were provided in a U.S. Department of Transportation document.[8]

1,3-Butadiene, Acetaldehyde, Benzene, and Formaldehyde Estimates
Emission factors for 1,3 butadiene, acetaldehyde, benzene, and formaldehyde were taken from the U.S. EPA Office Mobile Sources' Motor Vehicle-Related Air Toxics Study (MOBTOX).[9] These factors were applied to the 1990 VMT data. The table below contains more detailed calculations.

Methodology:

1990 Onroad Vehicle 1,3-Butadiene, Acetaldehyde, Benzene, and Formaldehyde Emissions

Pollutant	1,3 Butadiene	Acetaldehyde	Benzene	Formaldehyde
Fleet EF for all areas (g/mile)[9]	0.0156	0.0119	0.0882	0.0412
1990 National VMT[8]	2.147E+12	2.147E+12	2.147E+12	2.147E+12
National Emission Estimate (tons/yr)	**36,919.93**	**28,163.28**	**208,739.61**	**97,506.48**

Chromium, Manganese, Mercury, and Nickel Estimates

National estimates for chromium, manganese, mercury, and nickel were based on the combined emissions from the following seven on-road motor vehicle types: light-duty gasoline vehicles (LDGV), light-duty gasoline trucks (LDGT), heavy-duty gasoline vehicles (HDGV), heavy-duty diesel vehicles (HDDV), light-duty diesel trucks (LDDT), light-duty diesel vehicles (LDDV), and motorcycles. The estimate for all vehicles types except LDGV and LDGT was taken from a Rich Cook memorandum to Anne Pope.[7]

The emission estimate for LDGV and LDGT was calculated using emission factors from a 1997 Society of Automotive Engineers journal article by James Ball of the Ford Motor Company.[10] That article provided two sets of emission factors representing two different vehicle testing cycles, the Urban Dynamometer Driving Schedule (UDDS) and the US06 driving cycle. Based on a recommendation from the U.S. EPA's Office of Mobile Sources, the emission factors were weighted at 28% for the US06 cycle and 72% for the UDDS cycle to best reflect the range of actual vehicle operations. The emission factors were based on testing data from two LDGVs; for the purposes of this inventory, the factors were also applied to LDGTs since they often have similar engine types to those used in LDGVs. After calculating the weighted average emission factor for both vehicles, a simple average was taken to represent all LDGV and LDGT vehicle types. An emission estimate was then calculated using the 1990 national VMT data associated with LDGV and LDGT vehicles. Table 2, below, contains more detailed calculations.

POM as 7-PAH and 16-PAH

POM as 7- and 16-PAH emission estimates were developed based on vehicle types for areas with and without inspection and maintenance programs.

Total organic gas (TOG) emission factors for individual vehicle types for area with and without inspection and maintenance programs were taken from MOBTOX.[9] These TOG emission factors were converted to total hydrocarbon (THC) emission factors by using conversion factors developed by the U.S. EPA Office of Mobile Sources.[11]

These THC emission factors were weighted relative to the VMT mix as documented in MOBTOX. The THC emission factors were speciated to a Benzo(a)pyrene (B(a)P) emission factor based on a memorandum from Rich Cook to Anne Pope.[7]

The B(a)P emission factors were speciated to individual PAH species also based on data in an E-mail from Rich Cook.[12] The individual species were summed for the 7- and 16-PAH groups for each vehicle type. These 7- and 16-PAH emission factors were summed for areas with and without inspection and maintenance programs.

The 7- and 16-PAH emission factors were weighted based on the assumption in MOBTOX that 32 percent of fuel consumed for on-road vehicles occurs in areas with no inspection and maintenance programs and the remaining 68 percent of on-road vehicle fuel is consumed in areas with inspection and maintenance programs.[9]

These weighted emission factors were applied to 1990 Department of Transportation total national VMT data to estimate 7- and 16-PAH emissions for on-road vehicles. Table 3, below, contains more detailed calculations.

Methodology:

References

1 U.S. Environmental Protection Agency. 1997 (June). *1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report*. Research Triangle Park, NC.

2 U.S. Environmental Protection Agency. 1997 (December). *National Air Pollutant Emission Trends, 1900-1996*. EPA-454/R-97-011. Office of Air Quality Planning and Standards. Research Triangle Park, NC.

3 U.S. Environmental Protection Agency. 1995 (May). *TOC/PM Speciation Data System, Version 2.03.* Research Triangle Park, NC.

4 Cook, Rich. 1997 (July 14, 1997). E-mail to Richard Billings, Eastern Research Group, entitled, *Leaded Gasoline Fraction*. U.S. Environmental Protection Agency, Office of Mobile Sources. Ann Arbor, MI.

5 U.S. Environmental Protection Agency. 1998 (June 10, 1998). *National Emission Trends Viewer, Version 2.0 (CD-ROM)*. Emission Factor and Inventory Group. Research Triangle Park, NC.

6 Truex, Dr. Timothy J. and Dr. Joseph M. Norbeck. 1998 (March 16, 1998). *Evaluation of Factors That Affect Diesel Exhaust Toxicity*. University of California-Riverside, Center for Environmental Research and Technology. Riverside, CA.

7 Cook, Rich. 1997 (June 11, 1997). Memorandum to Anne Pope, U.S. EPA/Office of Air Quality Planning and Standards, entitled *Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs*. U.S. Environmental Protection Agency, Office of Mobile Sources. Ann Arbor, MI.

8 U.S. Department of Transportation. 1990. *Highway Statistics 1990*. FHWA-PL-91-003. Federal Highway Administration. Washington, DC.

9 U.S. Environmental Protection Agency. 1993 (April). (EPA 420-R-93-005). *Motor Vehicle-Related Air Toxics Study (MOBTOX)*. Office of Mobile Sources. Ann Arbor, MI.

10 Ball, James C. 1997. Article # 97FL-376. *Emission Rates and Elemental Composition of Particles Collected from 1995 Ford Vehicles Using the Urban Dynamometer Driving Schedule, the Highway Fuel Economy Test, and the US06 Driving Cycle*. Society of Automotive Engineers, Inc.

11 Cook, Rich. 1997 (January). E-Mail to Richard Billings, Eastern Research Group, Inc., entitled *File of TOG/THC Conversion Factors*. U.S. Environmental Protection Agency, Office of Mobile Sources. Ann Arbor, MI.

12 Cook, Rich. 1997 (March 21, 1997). E-Mail to Richard Billings, Eastern Research Group, Inc., entitled *FYI Minor Error in PAH Estimates*. U.S. Environmental Protection Agency, Office of Mobile Sources. Ann Arbor, MI.

Methodology:

Table 1: 1990 Onroad Vehicle Acrolein and Styrene Emissions

Part 1: Gasoline Vehicle Acrolein Emissions (Excluding HDGVs)

Gasoline Vehicle Type	LDGV + MC	LDGT	Total Gasoline Vehicle Exhaust	Acrolein Speciation Profile[3]	**Total Gasoline Vehicle (excluding HDGV) Acrolein Emissions**	Styrene Speciation Profile[7]	**Total Gasoline Vehicle (excluding HDGV) Styrene Emissions**
VOCs (tons/yr)[1]	3,946,988	1,621,777	5,568,765				
TOG/VOC factors[2]	1.2160	1.1800					
TOG (tons/yr)	4,799,537	1,913,697	6,713,234				
Exhaust Fraction[2]	0.75	0.77					
Exhaust TOG (tons/yr)	3,599,653	1,473,547	**5,073,200**	0.0006	**3,043.92**	0.0034	**17,248.88**

Part 2: HDGV Acrolein Emissions

Gasoline Vehicle Type	HDGV	Total Gasoline Vehicle Exhaust	Acrolein Speciation Profile[2]	**Total HDGV Acrolein Emissions**	Styrene Speciation Profile[2]	**Total HDGV Styrene Emissions**
VOCs (tons/yr)[1]	431,937	431,937				
TOG/VOC factors[2]	1.0860					
TOG (tons/yr)	469,084	469,084				
Exhaust Fraction[2]	0.70					
Exhaust TOG (tons/yr)	328,359	**328,359**	0.0044	**1,444.78**	0.00	**0.00**

Part 3: Diesel Vehicle Acrolein Emissions

Diesel Vehicle Type	LDDV	LDDT	HDDV	Total Diesel Vehicle Exhaust	Acrolein Speciation Profile[3]	**Total Acrolein Diesel Vehicle Emissions**	Styrene Speciation Profile[3]	**Total Styrene Diesel Vehicle Emissions**
VOCs (tons/yr)[1]	2,650	12,504	296,989	**312,143**	0.0035	**1,092.50**	0.0021	**655.50**

Part 4: 1990 Total Acrolein Emissions

	Acrolein	**Styrene**
Total Gasoline Vehicle Emissions (excluding HDGV)	3,043.92	17248.88
Total HDGV Emissions	1,444.78	0.00
Total Diesel Vehicle Emissions	1,092.50	655.50
Total 1990 Estimate	**5,581.20**	**17904.38**

1: U.S. Environmental Protection Agency. 1998 (June 10, 1998). National Emission Trends Viewer, Version 2.0 (CD-ROM). Emission Factor and Inventory Group. Research Triangle Park, NC.

2: Cook, Rich. 1997 (June 11, 1997). Memorandum to Anne Pope, U.S. EPA/Office of Air Quality Planning and Standards, entitled Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs."

3: Truex, Dr. Timothy J. and Dr. Joseph M. Norbeck. 1998 (March 16, 1998). Evaluation of Factors That Affect Diesel Exhaust Toxicity. University of California-Riverside, Center for Environmental Research and Technology. Riverside, CA.

Methodology:

Table 2: 1990 Onroad Vehicle Chromium, Manganese, Mercury, and Nickel Emissions

Part 1: Calculate HAP Emissions for All Vehicle Types Except LDGV and LDGT

HAP	HDGV*	HDDV*	LDDT*	LDDV*	MC*	Total Metric Tons	Total English Tons**
Chromium	0.54	15.24	0.04	0.16	0	15.98	17.61
Manganese	1.09	15.24	0.05	0.24	0	16.62	18.32
Mercury	0.09	4.35	0.02	0.08	0	4.54	5.00
Nickel	0.63	6.53	0.02	0.08	0	7.26	8.00

*1990 national emissions in metric tons/year from June 11, 1997 Memorandum from Rich Cook to Anne Pope.

** Conversion factor of 1.102311 from Josh Madison Conversion Software Home Page. Internet: http://www.joshmadison.com/software/convert/index.htm. August 17, 1998.

Part 2: Calculate HAP Emissions for LDGVs and LDGTs

Part 2a: Calculate Elemental HAP Emission Factors for LDGVs and LDGTs

	1995 Lincoln Mark VIII		1995 Mustang		
	USO6 Cycle	UDDS Cycle	USO6 Cycle	UDDS Cycle	Combined Average
HAP	EF (ug/mile)	EF (ug/mile)	EF (ug/mile)	EF (ug/mile)	EF (ug/mile)*
Chromium	0.90	8.50	4.10	3.30	4.95
Manganese	0.80	2.50	1.00	1.40	1.66
Nickel	2.60	6.00	3.60	1.60	3.60

* Combined average represents a weighted average of the US06 and UDDS emission factors for each vehicle (the weighting being 28% for the US06 factor, and 72% for the UDDS factor) and a subsequent straight average between the two weighted averages for each pollutant.

Source Part 2a: Ball, James C. " Emission Rates and Elemental Composition of Particles Collected from 1995 Ford Vehicles Using the Urban Dynamometer Driving Schedule, the Highway Fuel Economy Test, and the US06 Driving Cycle." Society of Automotive Engineers.

Part 2b: Calculate National VMT Associated with LDGVs and LDGTs

1990 National VMT (all vehicle types)* =	2.147E+12
VMT fraction for LDGVs* =	0.655
VMT fraction for LDGTs* =	0.243
1990 National VMT (LDGVs + LDGTs) =	1.92801E+12

* EPA. 1993. Motor Vehicle-Related Air Toxics Study. Office of Mobile Sources. EPA-420-R-93-005

Part 2c: Calculate National Elemental HAP Emissions for LDGVs and LDGTs

HAP	Emissions (tons/year)
Chromium	10.52
Manganese	3.52
Nickel	7.66

Part 3: Calculate Total HAP Emissions for All Vehicle Types

HAP	Part 1 Emissions (tons/yr)	Part 2 Emissions (tons/yr)	**Total HAP Emissions (tons/yr)**
Chromium	17.61	10.52	**28.13**
Manganese	18.32	3.52	**21.84**
Mercury	5.00	0.00	**5.00**
Nickel	8.00	7.66	**15.66**

Methodology:

Table 3: 1990 Onroad Vehicle 7-PAH & 16-PAH Emissions

Areas w / no I/M	TOG EF[1] (g/mile)	THC/TOG Conversion Factors[2]	THC EF (g/mile)	VMT mix[1]	Weighted THC EF (g/mile)	B(a)P/THC Ratio[3] (ug/g)	B(a)P EF (ug/mile)	Speciation Factor[4] 7-PAH/B(a)P	7-PAH EF (ug/mile)	Speciation Factor[4] 16-PAH/B(a)P	16-PAH EF (ug/mile)
	A	B	C (A*B)	D	E (C*D)	F	G (E*F)	H	I (G*H)	J	K (G*J)
LDGV	2.39	0.981	2.34	0.655	1.54	0.50	0.768	6.8	5.221	12.3	9.445
LDGT1	3.19	0.979	3.12	0.161	0.50	0.60	0.302	6.8	2.051	12.2	3.681
LDGT2	4.65	0.975	4.53	0.082	0.37	0.96	0.357	6.5	2.320	12	4.283
HDGV	8.68	0.969	8.41	0.031	0.26	1.42	0.370	6.2	2.296	11.8	4.369
LDDV	0.73	0.953	0.70	0.009	0.01	1.12	0.007	15.7	0.110	54.92	0.385
LDDT	1.05	0.953	1.00	0.002	0.00	1.12	0.002	15.7	0.035	54.92	0.123
HDDV	3.54	0.967	3.42	0.052	0.18	1.12	0.199	15.7	3.130	54.92	10.948
MC	2.65	0.969	2.57	0.008	0.02	1.47	0.030	6.1	0.184	11.8	0.356
Total	N/A	N/A	N/A	1	N/A	N/A	N/A	N/A	15.347	N/A	33.589

Areas w / Basic I/M	TOG EF[1] (g/mile)	THC/TOG Conversion Factors[2]	THC EF (g/mile)	VMT mix[1]	Weighted THC EF (g/mile)	B(a)P/THC Ratio[3] (ug/g)	B(a)P EF (ug/mile)	Speciation Factor[4] 7-PAH/B(a)P	7-PAH EF (ug/mile)	Speciation Factor[4] 16-PAH/B(a)P	16-PAH EF (ug/mile)
	A	B	C (A*B)	D	E (C*D)	F	G (E*F)	H	I (G*H)	J	K (G*J)
LDGV	1.83	0.981	1.80	0.655	1.18	0.50	0.588	6.8	3.998	12.3	7.232
LDGT1	3.19	0.979	3.12	0.161	0.50	0.60	0.302	6.8	2.051	12.2	3.681
LDGT2	4.65	0.975	4.53	0.082	0.37	0.96	0.357	6.5	2.320	12	4.283
HDGV	8.68	0.969	8.41	0.031	0.26	1.42	0.370	6.2	2.296	11.8	4.369
LDDV	0.73	0.953	0.70	0.009	0.01	1.12	0.007	15.7	0.110	54.92	0.385
LDDT	1.05	0.953	1.00	0.002	0.00	1.12	0.002	15.7	0.035	54.92	0.123
HDDV	3.54	0.967	3.42	0.052	0.18	1.12	0.199	15.7	3.130	54.92	10.948
MC	2.65	0.969	2.57	0.008	0.02	1.47	0.030	6.1	0.184	11.8	0.356
Total	N/A	N/A	N/A	1	N/A	N/A	N/A	N/A	14.124	N/A	31.376

1990 National Estimates (tons/year)

Pollutant	7-PAH	16-PAH
Fleet EF for all areas	14.52	32.085
1990 National VMT[5] :	2.147E+12	2.147E+12
Total	**34.35**	**75.93**

*The fleet EF for all areas is a composite w eighting base on percentage of total fuel use (32% for areas w ith no I/M and 68% for areas w ith I/M)

1: U.S. Environmental Protection Agency. 1993 (April). (EPA 420-R-93-005). Motor Vehicle-Related Air Toxics Study (MOBTOX). Office of Mobile Sources. Ann Arbor, MI.

2: Cook, Rich. 1997 (January). E-Mail to Richard Billings, Eastern Research Group, Inc., entitled File of TOG/THC Conversion Factors. U.S. Environmental Protection Agency, Office of Mobile Sources. Ann Arbor, MI.

3: Cook, Rich. 1997 (June 11, 1997). Memorandum to Anne Pope, U.S. EPA/Office of Air Quality Planning and Standards, entitled Source Identification and Base Year 1990 Emission Inventory Guidance for Mobile Source HAPs on the OAQPS List of 40 Priority HAPs. U.S. Environmental Protection Agency, Office of Mobile Sources. Ann Arbor, MI.

4: Cook, Rich. 1997 (March 21, 1997). E-Mail to Richard Billings, Eastern Research Group, Inc., entitled FYI Minor Error in PAH Estimates. U.S. Environmental Protection Agency, Office of Mobile Sources. Ann Arbor, MI.

5: U.S. Department of Transportation. 1990. Highw ay Statistics 1990. FHWA-PL-91-003. Federal Highw ay Administration. Washington, DC.

Methodology:

A 1995 base year estimate of all HAP emissions for facilities with continuous processes that will be subject to the Miscellaneous Organic NESHAP (MON) was provided by B. Gibbons.

There are approximately 150 facilities with continuous processes that will be covered by the MON.   Emissions (primarily from MON database) were spatially allocated according to the county proportion of national employment in SICs 282, 284, 285, 286, 287, 289, and 386. The TRIS database was used to supplement the ESD estimates by including the SIC code for Explosives. (These supplemented estimates from the TRIS database for SIC Code = 2892, SIC Description = Explosives). Note that TRIS data for SIC 2895 (Carbon Black Production) were not used in these estimates.

Some emissions attributed from this source category may also be included within portions of other source categories pertaining to manufacturing of various organic chemicals. Though this could result in double counting emissions from some portions of a source category, it is not possible to separate the “MON” components from the non-MON components.

Pollutants estimated from this source category:

1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dimethylhydrazine
1,2,4-Trichlorobenzene
Propylene Dichloride
1,2-Propyleneimine
1,3-Butadiene
1,3-Dichloropropene
1,4-Dichlorobenzene
1,4-Dioxane
2,4-D
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,4-Toluene Diisocyanate
2-Nitropropane
3,3'-Dichlorobenzidine
4,4'-Methylenedianiline
4-Nitrophenol
4,6-Dinitro-o-cresol
Acetaldehyde
Acetamide
Acetonitrile
Acrolein
Acrylamide
Acrylic Acid
Acrylonitrile
Allyl Chloride
Aniline
Antimony
Arsenic
Benzene
Benzotrichloride
Benzyl Chloride
Beryllium
Biphenyl
Bis(chloromethyl) Ether
Cadmium
Calcium Cyanamide
Captan
Carbaryl
Carbon Disulfide
Carbon Tetrachloride
Carbonyl Sulfide
Catechol
Chlordane
Chlorine
Chloroacetic Acid
Chlorobenzene
Chloroform
Chloromethyl Methyl Ether
Chloroprene
Chromium
Cobalt
Cresols
Cumene
Cyanide
Dibutyl Phthalate
Dichlorethyl Ether
Dichlorvis
Diethanolamine
Diethyl Sulfate
Dimethyl Phthalate
Dimethyl Sulfate
Epichlorohydrin
Ethyl Acrylate
Ethyl Chloride
Ethylbenzene
Ethylene Dibromide
Ethylene Dichloride
Ethylene Glycol
Ethylene Oxide
Formaldehyde
Glycol Ethers
Heptachlor
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hydrazine
Hydrochloric Acid
Hydrogen Fluoride
Hydroquinone
Lead Compounds
Maleic Anhydride
Manganese
Mercury
Methanol
Methyl Bromide
Methyl Chloride
Methyl Chloroform
Methyl Ethyl Ketone
Methyl Iodide
Methyl Isobutyl Ketone
Methyl Isocyanate
Methyl Methacrylate
Methyl t-Butyl Ether
Methylene Chloride
Methylene Diisocyante
Methylhydrazine
N,N-Dimethylaninline
Nickel
Nitrobenzene

Methodology:

o-Anisidine	Quinoline	Vinyl Acetate
1,4-Phenylenediamine	Quinone	Vinyl Bromide
Pentachloronitrobenzene	Selenium	Vinyl Chloride
Phenol	Styrene	Vinylidene Chloride
Phosgene	Styrene Oxide	Xylenes
Phosphorous	Tetrachloroethylene	
Phthalic Anhydride	Titanium Tetrachloride	
Polycyclic Organic Matter as 16-PAH	Toluene	
Propionaldehyde	Trichloroethylene	
Propylene Oxide	Trifluralin	

<u>References:</u>

Gibbons, B. Alpha-Gamma Inc. Memo to R. McDonald, U.S. Environmental Protection Agency, Emission Standards Division. “Speciation of HAPs from Facilities Subject to MON.” June 19, 1997.

U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

National emissions for the HAPs on the following page for Municipal Solid Waste (MSW) landfills were estimated using the uncontrolled landfill gas concentrations for individual HAPs listed in the following reference:

U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1997.

The HAP concentrations provided in the above reference are based on the EPA's Landfill Air Emissions Estimation model. In order to calculate mass emissions for each HAP, a total estimate of landfill gas has to be calculated. This calculation was done using the total mass of methane emitted on a national level. A national estimate of methane (CH_4) generated (9.25E+9 kg/yr) from MSW landfills in the United States was obtained from the following reference:

U.S. Environmental Protection Agency. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1994. Office of Policy, Planning and Evaluation, Washington, D.C. EPA-230-R-96-006. November 1995.

The methane emissions estimate of 9.25E+9 kg/yr represents the average of the range (7.5 to 11 million metric tons) reported for U.S. methane emissions from landfills in 1990, excluding emissions from industrial landfills. Industrial landfills were excluded because the HAP concentrations provided in AP-42 do not represent industrial landfills.

Using the AP-42 guidance, the national volumetric flow rate of CH_4 (m^3/yr) was calculated based on the national mass flow rate of CH_4 (kg/yr), assuming that the average landfill gas temperature is 25°C. Next, the national volumetric flow rate of landfill gas (m^3/yr) was calculated, based on the national volumetric flow rate of CH_4 (m^3/yr), assuming the landfill gas consists of 50 percent CH_4 and 50 percent CO_2 by volume. Landfills are generally considered uncontrolled sources so no emission reduction controls were assumed in estimating HAP emissions.

Example Calculation for Benzene Emissions:
Using equations provided in the AP-42 document to determine benzene emissions, the national volumetric emission rate of benzene (m^3/yr) was then calculated based on the national volumetric flow rate of landfill gas (m^3/yr), assuming the benzene concentration in landfill gas is 1.91 ppmv (i.e., the benzene emission concentration provided in the AP-42 document for an MSW landfill with an “unknown” status with regard to co-disposal with hazardous waste). Similarly, the AP-42 concentrations of other pollutants addressed in this inventory were used to calculate their emissions. Finally, the national mass emission rate of benzene (kg/yr) was calculated based on the national volumetric emission rate of benzene (m^3/yr), assuming the landfill gas temperature is 25°C.

Methodology:

Municipal Lanfills: Lanfills (excluding Gas Flares)

The emissions in Tables 2 and 4 are estimated using the follow ing calculations:

1. Calculate volumetric emissions (m3) of landfill gas (LFG) from the mass emissions of methane using PV=nRT, n=mass(kg)/MW, P=1, & 1kg=1000g, then V=(mass*R*T*1,000)/MW
2. Determine volumetric emissions (m3) of pollutant from the volumetric emissions of LFG and pollutant concentration in LFG by multiplying pollutant concentration (ppmv) by LFG emission (m3)
3. Convert pollutant volumetric emissions (m3) to mass emissions (Mg) using PV=nRT, n=mass(kg)/MW, P=1, & 1kg=1000g, then mass=(V*MW)/(R*T*1,000)

Table 1: Inputs for Table 2

Methane emissions (kg):	9.25E+09
Methane % by Volume of LFG:	55%
CO2 % by Volume of LFG:	40%
LFG temp (C):	25
Methane MW (g/g mole)	16.00
Methane emissions (m^3):	1.41E+10
LFG emissions (m^3)	2.57E+10

Table 2: Pollutant Mass Emissions from Landfills Based on the Mass Emissions of Methane from Landfills

Pollutant:	Pollutant MW (g/g mole)	Pollutant concentration (ppmv)	Pollutant volumetric emission rate (m3)	Pollutant mass emission rate (kg):	**Pollutant mass emission rate (ton):**
1,1,2,2- tetrachloroethane	167.85	1.11	28,528	195,841	**216**
1,2- dichloropropane	112.98	0.18	4,626	21,376	**24**
Acrylonitrile	53.06	6.33	162,689	353,045	**389**
Benzene	78.11	1.91	49,089	156,819	**173**
Chloroform	119.39	0.03	771	3,765	**4**
Ethylene dichloride	98.96	0.41	10,538	42,648	**47**
Tetrachloroethylene	165.83	3.73	95,866	650,176	**716**
Trichloroethylene	131.40	2.82	72,477	389,496	**429**
Vinyl Chloride	62.50	7.34	188,647	482,209	**531**
Vinylidene Chloride	96.94	0.20	5,140	20,379	**22**

Table 3: Input Values for Methylene Chloride

Methane emissions (kg):	9.25E+09
Methane % by Volume of LFG:	50%
CO2 % by Volume of LFG:	50%
LFG temp (C):	25
Methane MW (g/g mole)	16.00
Methane emissions (m^3):	1.41E+10
LFG emissions (m^3)	2.83E+10

Table 4: Methylene Chloride Mass Emissions from Landfills Based on the Mass Emissions of Methane from the Landfill

Pollutant:	Pollutant MW (g/g mole)	Pollutant concentration (ppmv)	Pollutant volumetric emission rate (m3)	Pollutant mass emission rate (kg):	**Pollutant mass emission rate (ton):**
Methylene chloride	84.94	14.30	404,280	1,404,430	**1,548**

Methodology:

The Polycyclic Organic Matter as 16-PAH and 7-PAH estimates are from the following reference:

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Emissions from landfill gas flares were estimated using emission factors from the following reference:

U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

The factors provided in FIRE represent exhaust emissions from waste gas flares using an afterburner device. The factors are in units of lb of pollutant per MMBtu of heat input for landfill gas. The activity level data were obtained from the following report:

U.S. Environmental Protection Agency. Inventory of Greenhouse Gas Emissions and Sinks: 1990-1994. Office of Policy, Planning and Evaluation, Washington D.C. EPA-230-R-96-006. November 1995.

This report provides a daily estimate of landfill gas recovery for 1992. In order to estimate 1990 activity levels, the 1992 value was scaled back using the ratio of methane gas recovered in 1990 to methane gas recovered in 1992 (these values were also provided in the report). The methane gas estimates are directly related to the landfill gas total estimates since methane represents approximately 50% of the total gas by volume. After scaling back to the 1990 base year, annual activity was estimated assuming activity for 365 days/year. The above report estimates that 25% of the total landfill gas recovered is flared, so this fraction was applied to the annual estimate of total landfill gas recovered. The last step was to convert the estimate of landfill gas flared from units of cubic feet to heat input using a thermal conversion factor of 492.74 Btu per cubic foot of gas. The source of this conversion factor is:

Berenyi, Eileen B. 1991-92 Methane Recovery from Landfill Yearbook, Directory and Guide. Governmental Advisory Associates, Inc., New York, NY. 1991.

Methodology:

Landfills: Gas Flares					
all emission factors are from FIRE					
all emission factors are in units of lb/MMBtu					
	pollutant	factor			
	chlorobenzene	2.75E-06			
	chloroform	2.57E-06			
	vinyl chloride	4.17E-06			
	benzene	7.10E-06			
	carbon tetrachloride	7.26E-07			
	methylene chloride	2.14E-04			
	polychlorinated biphenyls	6.10E-08			
	tetrachloroethylene	3.48E-06			
	toluene	1.23E-04			
	1,1,1-trichloroethane	1.02E-05			
	trichloroethylene	1.26E-06			
	xylene, mixed isomers	2.23E-05			
National Emissions					
calculate national activity level:					
1992 total landfill gas recovered=		410,823,840	cubic ft./day		
1990 methane recovered =		1200	thousand tonnes		
1992 methane recovered=		1440	thousand tonnes		
ratio of 1990 to 1992 methane=		0.833333333			
1990 daily landfill gas recovered=		342353200	cubic ft./day		
1990 annual landfill gas recovered=		1.24959E+11	cubic ft./year (assumes 365 days/yr)		
1990 total landfill gas flared=		31239729500	cubic ft/yr	(assumes 25% of recovered gas)	
		1.53931E+13	Btu/yr (assumes heating value of 492.74 Btu/cubic ft)		
		15393064.31	MMBtu/yr		
calculate national emissions:					
	pollutant	lb/yr	tons/yr		
	chlorobenzene	42.33	0.02		
	chloroform	39.56017529	0.019780088		
	vinyl chloride	64.18907819	0.032094539		
	benzene	109.2907566	0.054645378		
	carbon tetrachloride	11.17536469	0.005587682		
	methylene chloride	3300.272989	1.650136494		
	polychlorinated biphenyls	0.94	4.69E-04		
	tetrachloroethylene	53.49089849	0.026745449		
	toluene	1893.35	0.95		
	1,1,1-trichloroethane	157.01	0.08		
	trichloroethylene	19.34446392	0.009672232		
	xylene, mixed isomers	343.27	0.17		

Methodology:

Dioxin, mercury, lead, cadmium, hydrogen chloride, nickel, chromium, arsenic

A national emissions inventory estimate for 8 hazardous air pollutants (HAPs) from municipal waste combustors (MWCs) for 1990 was established. The 8 HAPs estimated were dioxin, mercury, lead, cadmium, hydrogen chloride, nickel, chromium, and arsenic. These estimates were calculated on a unit basis for each plant known to be operating in 1990. These estimates were generated using AP-42 emission factors and a plant list of small and large MWCs that indicated the number of units, combustor type, unit capacity, and air pollution control device.

The list of unit names, total plant capacity, number of units, and combustor types was taken from the 1995 MWC Inventory Database. It was assumed that total plant capacity had not changed since 1990; however, this list was updated for small plants based on data provided by EPA/ESD. Any MWC in the inventory that was not covered in the large or small categories, i.e., unit capacity was less than 35 tons per day, was not included in this 1990 baseline emissions estimate. Air pollution control devices operating in 1990 were listed for each MWC in information provided by ESD (Reference 1).

National emission estimates were developed for each plant by multiplying an appropriate emission factor by an activity factor. Emission factors for many of the combustor type-air pollution control device (APCD) combinations listed in the inventory are found in AP-42, Section 2.1 (1993). For those combustor type-APCD combinations not covered in AP-42, default emission factors were assigned. These default emission factors are consistent with those published in the memo from Chad Leatherwood, ERG, to Julie Andresen, EPA (Reference 2). These emission factors were presented to the ESD contact for the Municipal Waste Combustor MACT in a memorandum from Eastern Research Group, Inc. (Reference 3).

The activity factors were calculated by multiplying the total plant capacity by a volumetric flow factor and a capacity factor. The volumetric flow factor is a standard conversion factor used to determine exhaust flow rates based on heat input. The capacity factor represents the fraction of annual operational time that a plant has operated. All emission estimates were based on pollutant concentrations corrected to 7 percent oxygen.

Formaldehyde, POM as 16-PAH, manganese

Emission factors for formaldehyde, polycyclic organic matter (POM) as 16-PAH, and manganese for municipal waste combustors (MWCs) were assumed to be the same as those for medical waste incinerators (MWIs), as was recommended by EPA (Reference 4). These emission factors were given in units of pound of pollutant per ton of waste. These emission factors were multiplied by total plant capacity, in units of ton per day, for each facility on a list of MWCs operating in the United States in 1990. This number was then adjusted for a unitless capacity factor, which represents the percentage of the total plant capacity that a plant is actually operating. These results were then converted to be reported in units of ton of pollutant per year. Emissions from each plant were then summed to produce a national emissions estimate. Data for plant capacity and the capacity factor were available in a memorandum from Chad Leatherwood, Eastern Research Group, Inc., to Julie Andresen, EPA (1997).

Example Calculation:

(0.0016 lb formaldehyde/ton waste) * (2250 ton waste burned/day) * (0.91 capacity factor) *
(365 day/yr) * (0.0005 ton/lb) = 0.59787 ton formaldehyde/yr

The POM as EOM estimate was reported in the 112(c)(6) report (Reference 5).

(References on following page.)

Methodology:

References:

1. “Status of Air Pollution Control Devices on Municipal Waste Combustor Units.” Information provided to Eastern Research Group, Inc. from Walt Stevenson, EPA/ESD. July 19,1998.

2. Leatherwood, Chad, ERG, to Julie Andresen, EPA. Memorandum: “Inventory and Emission Estimates for Municipal Waste Combustor Units Covered by Proposed Federal Section 111 (d)/129 Plan.” December 23, 1997.

3. “1990 Municipal Waste Combustor National Emission Inventory”. Memorandum from Eastern Research Group, Inc., to Walt Stevenson, EPA/ESD. July 14, 1998.

4. Porter, Fred, U.S. Environmental Protection Agency, Emissions Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Municipal Waste Combustor information in the “Baseline Emission Inventory of HAP Emissions from MACT Sources-Interim Final Report,” September 18, 1998. November 13, 1998.

5. U.S. Environmental Protection Agency. *1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Aldylated Lead. Final Report.* Research Triangle Park, North Carolina. June 1997.

APPENDIX A: NATIONAL ESTIMATES - Municipal Waste Combustors

Methodology:

State	Total Plant Capacity	Capacity Factor	Formaldehyde(TPY)	POM(TPY)	Mn(TPY)
CT Total	6045	0.91	1.61E+00	9.04E-01	6.02E-01
MA Total	10760	0.91	2.86E+00	1.61E+00	1.07E+00
ME Total	2150	0.91	5.71E-01	3.21E-01	2.14E-01
NH Total	832	0.91	2.21E-01	1.24E-01	8.29E-02
AK	70	0.74	1.51E-02	8.51E-03	5.67E-03
AK	50	0.91	1.33E-02	7.47E-03	4.98E-03
ID Total	50	0.74	1.08E-02	6.08E-03	4.05E-03
OR	125	0.74	2.70E-02	1.52E-02	1.01E-02
OR	550	0.91	1.46E-01	8.22E-02	5.48E-02
WA	478	0.91	1.27E-01	7.14E-02	4.76E-02
WA	100	0.74	2.16E-02	1.22E-02	8.10E-03
NJ Total	3252	0.91	8.64E-01	4.86E-01	3.24E-01
NY	8973	0.91	2.38E+00	1.34E+00	8.94E-01
NY	400	0.74	8.64E-02	4.86E-02	3.24E-02
MD	3750	0.91	9.96E-01	5.61E-01	3.74E-01
MD	360	0.74	7.78E-02	4.38E-02	2.92E-02
PA Total	2064	0.91	5.48E-01	3.09E-01	2.06E-01
VA	6275	0.91	1.67E+00	9.38E-01	6.25E-01
VA	50	0.74	1.08E-02	6.08E-03	4.05E-03
FL	11960	0.91	3.18E+00	1.79E+00	1.19E+00
FL	60	0.74	1.30E-02	7.29E-03	4.86E-03
GA Total	500	0.91	1.33E-01	7.47E-02	4.98E-02
MS Total	150	0.91	3.99E-02	2.24E-02	1.49E-02
NC Total	684	0.91	1.82E-01	1.02E-01	6.82E-02
SC	600	0.91	1.59E-01	8.97E-02	5.98E-02
SC	270	0.74	5.83E-02	3.28E-02	2.19E-02
TN Total	1250	0.91	3.32E-01	1.87E-01	1.25E-01
IL Total	1600	0.91	4.25E-01	2.39E-01	1.59E-01
IN Total	2362	0.91	6.28E-01	3.53E-01	2.35E-01
MI Total	5225	0.91	1.39E+00	7.81E-01	5.21E-01
MN	4334	0.91	1.15E+00	6.48E-01	4.32E-01
MN	288	0.74	6.22E-02	3.50E-02	2.33E-02
OH Total	1500	0.91	3.99E-01	2.24E-01	1.49E-01
WI	100	0.74	2.16E-02	1.22E-02	8.10E-03
WI	400	0.91	1.06E-01	5.98E-02	3.99E-02
OK	105	0.74	2.27E-02	1.28E-02	8.51E-03
OK	1125	0.91	2.99E-01	1.68E-01	1.12E-01
TX Total	195	0.74	4.21E-02	2.37E-02	1.58E-02
MT Total	72	0.74	1.56E-02	8.75E-03	5.83E-03
UT Total	400	0.91	1.06E-01	5.98E-02	3.99E-02
CA Total	2560	0.91	6.80E-01	3.83E-01	2.55E-01
HI Total	2160	0.91	5.74E-01	3.23E-01	2.15E-01
Grand Total			2.23E+01	1.25E+01	8.35E+00

Methodology:

Approach: An emission factor from the *1990 Emissions Inventory of Section 112(c)(6) Pollutants*, June 1997, was multiplied by the estimated amount of naphthalene consumed annually for miscellaneous uses. The amount of naphthalene consumed in 1990 for miscellaneous uses was reported in *Chemical Products Synopsis - Naphthalene*, February 1991 to be 3 percent of the total production (245 million pounds), or 7.35 million pounds. Miscellaneous uses of naphthalene were not defined, so no facilities could be identified. Spatial allocation of the emissions estimates for miscellaneous uses of naphthalene was based on the county proportion of national employment in SIC 2819, as follows:

County Emissions = County SIC Employment / National SIC Employment x National Emissions

Data Qualifiers:
The 16-PAH emission factor was developed from individual PAH emission factors for miscellaneous uses of naphthalene. The 16-PAH factor only includes naphthalene.

Emissions Estimate:
0.34 lb 16-PAH / 1000 lb naphthalene consumed for miscellaneous use x (7.35 million pounds naphthalene) =
2499 lbs 16-PAH x (1 ton / 2000 lbs) = 1.25 tons 16-PAH / year from miscellaneous uses of naphthalene

References:

U.S. Environmental Protection Agency. *1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM); 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) / 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs); Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report*. Research Triangle Park, North Carolina. June 1997.

Mannsville Chemical Products Corporation. *Chemical Products Synopsis - Naphthalene*. February, 1991.
1990 Directory of Chemical Producers. SRI International. Menlo Park, CA. p. 805.

Methodology:

Natural Gas Transmission and Storage

The estimate for Benzene emissions for this source category is 345 tons per year*. This estimate was provided by Greg Nizich (EPA/OAQPS).

* Note that this estimate is for urban areas only.

References

1. Nizich, G., U.S. Environmental Protection Agency, Emission Standards Division. Note to B. Driscoll, U.S. EPA. "Comments on MACT inventory." November 3, 1998.

Methodology:

Emissions from Nutritional Yeast Manufacturing

The estimated nationwide baseline emissions of acetaldehyde were calculated to be approximately 254 tons per year. This is documented in the memorandum "Nationwide Baseline Emissions of Acetaldehyde in the Nutritional Yeast Manufacturing", dated August 8, 1998. There are ten nutritional yeast manufacturing facilities operating in the U.S., not thirteen as indicated in the PMACT Technical Support Document (September 30, 1994). The estimate of 254 tons per year represents the modeled emissions from all ten of the facilities.

References:

J. Miller, EI, Inc. to Friedman, EC/R, Inc. Memorandum: Baker's Yeast Manufacturing NESHAP Project: Nationwide Baseline Emissions. August 6, 1998. (Item II-B-27 in Docket A-97-13).

Methodology:

George Viconovic, EC/R, contacted Richard Billings, ERG, on behalf of Martha Smith, EPA/ESD, with the benzene estimate (18,200 tons/yr) for this source category. This estimate was derived from the MACT study of this category.

Five non-112(k) HAP estimates were provided by Martha Smith, U.S. EPA/ESD to Richard Billings, ERG. The non-112(k) HAPs include:

2,2,4-Trimethylpentane
Ethylbenzene
Hexane
Toluene
Xylene

References

Smith, M. U.S. Environmental Protection Agency, Emission Standards Division. E-mail to Richard Billings, ERG. "HAP emissions from O&G [Oil & Gas] production." September 12, 1997.

Viconovic, G. EC/R. Telecom with R. Billings, ERG. "Benzene Estimate for Glycol Dehydration Units." 8 July 1997.

Methodology:

Open Burning: Forest and Wildfires

The estimates for 1,3-Butadiene, Benzene, and Formaldehyde come directly from the Section 112(k) report (U.S. EPA, 1996).

Dioxin/Furans, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH
The estimates for Dioxins/Furans, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH are derived from the Open Burning estimates found in the Section 112(c)(6) (EPA, 1997). For the purpose of this report the estimates are divided between Wildfires/Forest fires and Prescribed burnings using activity data from the Section 112(k) (U.S. EPA, 1996).

Acetaldehyde and Acrolein
Acetaldehyde and Acrolein emission factors from Ward et al. (1997) were applied to the activity level reported in the Section 112(k) report (U.S. EPA, 1996).

References

U.S. Environmental Protection Agency. National Urban Area Source Emissions of Benzene, 1,3-Butadiene, Formaldehyde, Trichloroethylene, Perchloroethylene, Methylene Chloride, and Carbon Tetrachloride. Final Report. Research Triangle Park, North Carolina. March 1996.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Ward, D., Peterson, J., and Hao, W. An Inventory of Particulate Matter and Air Toxic Emissions from Prescribed Fires in the U.S. For 1989. U.S. Forest Service. Missoula, Montana, and the Wood Chemistry Laboratory, school of Forestry, University of Montana, Missoula, Montana. 1993.

Methodology:

Activity data: 53000000 tons biomass

Emission Factor:

Fuel model	Acetaldehyde Emission factor (g/kg biomass)	Acetaldehyde Emission factor (lb/ton biomass)	Acrolein Emission factor (g/kg biomass)	Acrolein Emission factor (lb/ton biomass)
1	0.24	0.48	0.23	0.46
2	0.92	1.84	0.69	1.38
3	0.11	0.22	0.15	0.3
4	0.92	1.84	0.69	1.38
5	0.28	0.56	0.26	0.52
6	0.53	1.06	0.43	0.86
7	0.24	0.48	0.23	0.46
8	0.92	1.84	0.69	1.38
average	0.52	1.04	0.42125	0.8425

Estimate:

National Estimate = Activity Data * Average Emission Factor

HAP	Activity Data (ton)	Average Emission Factor (lb/ton)	National Estimate (lb/yr)	National Estimate (tons/yr)
Acetaldehyde	53000000	1.04	55120000	27560
Acrolein	53000000	0.8425	44652500	22326.25

Methodology:

Activity data:	5.30E+07	tons biomass Wildfires
	9.50E+07	tons biomass Wildfires and Prescribed Burning

Estimation Method for Dioxins/Furans, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH:

Emission estimates for forest/w ild fires and prescribed burning are proportional to their respected activity because the emission factors for prescribed burning and forest/w ild fires are assumed to be equal. A Wildfire factor w ill be used to develop emissions for Dioxins/Furans, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH

Wildfire Factor =	5.30E+07	(tons w ild forest biomass)/	9.50E+07	(tons biomass burned)
Wildfire Factor =	0.5579			

National Estimate:

Pollutant	Total Open Burning (Wildfire and Prescribed Burning) Estimate (tpy)	Wildfire Factor	Forest and Wildfire Estimate (tpy)
Dioxins/Furans	9.50E-05	0.5579	5.300E-05
Polycyclic Organic Matter as 7-PAH	964	0.5579	5.378E+02
Polycyclic Organic Matter as 16-PAH	2540	0.5579	1.417E+03

Methodology:

Open Burning: Prescribed Burnings

The estimates for 1,3-Butadiene, Benzene, and Formaldehyde come directly from the Section 112(k) report (U.S. EPA, 1996).

Dioxin/Furans, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH
The estimates for Dioxins/Furans, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH are derived from the Open Burning estimates found in the Section 112(c)(6) (EPA, 1997). For the purpose of this report the estimates are divided between Wildfires/Forest fires and Prescribed burnings using activity data from the Section 112(k) (U.S. EPA, 1996).

Acetaldehyde and Acrolein
Acetaldehyde and Acrolein emission factors from Ward et al. (1997) were applied to the activity level reported in the Section 112(k) report (U.S. EPA, 1996).

References

U.S. Environmental Protection Agency. National Urban Area Source Emissions of Benzene, 1,3-Butadiene, Formaldehyde, Trichloroethylene, Perchloroethylene, Methylene Chloride, and Carbon Tetrachloride. Final Report. Research Triangle Park, North Carolina. March 1996.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Ward, D., Peterson, J., and Hao, W. An Inventory of Particulate Matter and Air Toxic Emissions from Prescribed Fires in the U.S. For 1989. U.S. Forest Service. Missoula, Montana, and the Wood Chemistry Laboratory, school of Forestry, University of Montana, Missoula, Montana. 1993.

Methodology:

Activity data: 42000000 tons biomass

Emission Factor:

Fuel model	Acetaldehyde Emission factor (g/kg biomass)	Acetaldehyde Emission factor (lb/ton biomass)	Acrolein Emission factor (g/kg biomass)	Acrolein Emission factor (lb/ton biomass)
1	0.24	0.48	0.23	0.46
2	0.92	1.84	0.69	1.38
3	0.11	0.22	0.15	0.3
4	0.92	1.84	0.69	1.38
5	0.28	0.56	0.26	0.52
6	0.53	1.06	0.43	0.86
7	0.24	0.48	0.23	0.46
8	0.92	1.84	0.69	1.38
average	0.52	1.04	0.42125	0.8425

Estimate:

National Estimate = Activity Data * Average Emission Factor

HAP	Activity Data (ton)	Average Emission Factor (lb/ton)	National Estimate (lb/yr)	National Estimate (tons/yr)
Acetaldehyde	42000000	1.04	43680000	21840
Acrolein	42000000	0.8425	35385000	17692.5

Methodology:

Activity data: 4.20E+07 tons biomass Prescribed Burning
9.50E+07 tons biomass Wildfires and Prescribed Burning

Estimation Method for Dioxins/Furans, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH:

Emission estimates for forest/wild fires and prescribed burning are proportional to their respected activity because the emission factors for prescribed burning and forest/wild fires are assumed to be equal. A Prescribed Burning factor will be used to develop emissions for Dioxins/Furans, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH

Prescribed Burning Factor = 4.20E+07 (tons biomass prescribed burning)/ 9.50E+07 (tons biomass burned)
Prescribed Burning Factor = 0.4421

National Estimate:

Pollutant	Total Open Burning (Wildfire and Prescribed Burning) Estimate (tpy)	Wildfire Factor	Prescribed Burning Estimate (tpy)
Dioxins/Furans	9.50E-05	0.4421	4.200E-05
Polycyclic Organic Matter as 7-PAH	964	0.4421	4.262E+02
Polycyclic Organic Matter as 16-PAH	2540	0.4421	1.123E+03

Methodology:

EMISSIONS FROM OPEN BURNING OF SCRAP TIRES

Approach:
National emissions were estimated by multiplying emission factors for nickel, lead, arsenic, chromium, styrene, 7-PAH and 16-PAH by the number of scrap tires that burn in open piles each year. These are scrap tire piles at recycling facilities and in legal and illegal dumps that accidentally catch fire, and should be distinguished from tires that are combusted in waste-to-energy facilities or in conventional combustion devices as a supplemental fuel.

The emission factors for the metals and styrene were obtained from AP-42 (U.S. EPA,1995). The emission factors for 7-PAH and 16-PAH were taken from the Section 112(c)(6) report (U.S. EPA, 1997). The average number of tires that burn openly each year was estimated with advice from Dr. Jonathan Barnett, Center for Fire Safety Studies, WPI (Barnett, 1997).

References:

U.S. Environmental Protection Agency. *Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources*. Research Triangle Park, North Carolina. 1995.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Barnett, Jonathan. Center for Fire Safety Studies, Worcester Polytechnic Institute, Worcester, MA. Personal communication with Eugene Paik, ERG. July 22, 1997. Estimating average number of scrap tire fires annually in the U.S.

Activity: 7.50E+06 tires burned/year
20 lb/tire lb chunk tires burned/year
150,000,000 lb shredded tires burned/year
75,000 tons tires burned/year

Pollutant	Emission Factors (lb pollutant/ton tires burned)			Emissions (tons pollutant/yr)	Emissions (lb pollutant/yr)
	Chunk	Shredded	Average		
Ni	4.74E-03	2.15E-03	3.45E-03	0.13	258
Pb	6.70E-04	2.00E-04	4.35E-04	0.016	33
As	1.00E-04	4.00E-04	2.50E-04	0.0094	19
Cr	3.94E-03	3.43E-03	3.69E-03	0.14	276
Styrene	1.24E+00	1.30E+00	1.27E+00	0.48	95,250
7-PAH	---	---	1.40E+00	52.5	589,000
16-PAH	---	---	7.85E+00	294	105,000

Example Calculation:

Estimate: (75,000 tons tire burned/yr)*(3.45E-3 lb Nickel/ton tire burned) = 1.3E-01 ton Nickel/yr
258 lb Nickel/yr

Methodology:

Approach:
1990 estimate of emissions from manufacturing of cadmium compounds are from the document "Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds", July 1995. This document includes emissions estimates for the following: cadmium refining & cadmium oxide production, cadmium stabilizers production, use of cadmium stabilizers for plastics, other cadmium compound production, and cadmium electroplating. Individual tables in the L & E identify, by process, each company and location reporting cadmium emissions in the 1990 Toxic Chemicals Release Inventory (TRI). Spatial allocation of the estimates was based on the location of the facilities identified on Table 4-12 in the L & E.

References:
U.S. Environmental Protection Agency. Locating and Estimating Air Emissions From Sources of Cadmium and Cadmium Compounds. Sections 4 and 5. From the: Air CHIEF CD-ROM, Version 4.0. EPA-454/C-95-001. Research Triangle Park, North Carolina. July 1995.

APPENDIX A: NATIONAL ESTIMATES - Other Cadmium Compound Production

Methodology:

Facility Name	Facility Location	Cadmium Emissions (lb/yr)	Cadmium Emissions (ton/yr)	State FIP Code	County FIP Code
American Microtrace Corp	Fairbury, NE	5	0.0025	31	095
CP Chemicals Inc	Sumter, SC	0	0	45	085
Hall Chemical Co	Arab, AL	0	0	01	095
Shepherd Chemical Co	Cincinnati, OH	0	0	39	061
1990 Annual Emission Estimate =	0.0025	tons cadmium compounds from manufacture of inorganic compounds			

Methodology:

The Polycyclic Organic Matter as 16-PAH estimate was provided in the 112(c)(6) report (US EPA, 1997).[5]

For the remaining HAPS, 1996 Facility specific estimates were provided by R. Lucas, EPA/OAQPS.[2] These 1996 estimates were adjusted for 1990 based on the ratio of 1990 refinery activity to 1996 refinery activity.[3-4]

Using this approach, the following HAPs were estimated:

1,3-Butadiene*	Cyanide (includes HCN)*
Acetaldehyde*	Formaldehyde*
Antimony*	Hydrogen Chloride
Arsenic*	Lead
Benzene*	Manganese
Beryllium*	Mercury
Cadmium	Nickel
Carbon Disulfide	Phenol*
Carbonyl Sulfide	Selenium
Chlorine	Toluene*
Chromium	Xylene*
Cobalt	

* Revised estimates provided by R. Lucas, EPA/OAQPS in memo to Greg Nizich (EPA/OAQPS).[1]

References:

1. Lucas, R., U.S. Environmental Protection Agency, Emission Standards Division. "Review of Baseline Emission Inventory" memo to Greg Nizich, U.S. EPA/ Emissions Standards Division. October 16, 1998.

2. Lucas, R., U.S. Environmental Protection Agency. "Facility Information Database (Request for Data from Barbara Driscol)." Research Triangle Park, North Carolina. June 1998.

3. Oil and Gas Journal. "1996 Worldwide Refining Survey." December 23, 1996.

4. Oil and Gas Journal. "Forecast and Review." January 27, 1997.

5. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

A summary report from J. F. Durham EPA/OAQPS to Barbara Driscoll provided emission estimates used in the 1995 Petroleum Refinery MACT rule and documented 1990 HAP emissions:

Pollutant	Mg/yr	Ton/yr
Benzene	5700	6,283
2, 2, 4-Trimethylpentane	21,400	23,589
Biphenyl	36	40
Cresols	440	485
Cumene	1,120	1,235
Ethylbenzene	2,900	3,197
Hexane	22,500	24,802
MTBE	3,000	3,307
Naphthalene	710	783
Phenol	180	194
Styrene	1,400	1,543
Toluene	13,300	14,661
Xylene	11,300	12,456

Note this estimate does not include catalytic regeneration units from fluid catalytic cracking units, catalytic reformers and tail gas vents from sulfur recovery plants.

Reference

Summary report from J.F. Durham to Barbara Driscoll, U.S. EPA/OAQPS, 112(k) Inventory-Petroleum Refineries, June 18, 1997.

Methodology:

Estimation Approach:

Estimates of emissions from pharmaceutical production are from the “Basis and Purpose Document - Pharmaceutical Production NESHAP”, June 1997. This report summarizes 1992 national emissions data for numerous hazardous air pollutants (HAPs) listed on the following page. The estimates were based on Section 114 questionnaire responses from 165 facilities producing one or more pharmaceutical products.

The 1992 estimates were not back-calculated to represent 1990 emissions because the activity data necessary to do this (production and waste water flow data) were not available.

Tables 5-2 through 5-4 in the Basis and Purpose Document present uncontrolled and baseline emissions data for each pollutant by facility source. The baseline emissions data are summarized below for those HAPs applicable to this inventory.

The estimate for hydrazine from wastewater was revised by the EPA after the original estimate was published in the Basis and Purpose document (McDonald, 1999). This revision was based on the combination of onsite biotreatment and a change to the Henry’s Law Constant for hydrazine used in the Water8 model.

Data Qualifiers:

The Basis and Purpose Document estimates uncontrolled and baseline emissions from equipment leaks to be 3000 Mg/year. The data are not speciated in the report so it is assumed for this inventory that emissions from equipment leaks are composed of the same HAPs, and with the same concentration ratio for each HAP as from process vents. Methylene chloride is excluded from this calculation because the baseline estimate for equipment leak emissions exempted processes that contained methylene chloride and carbon tetrachloride because these HAPs are covered under Subpart I of the Hazardous Organic NESHAP (HON).

This source category includes those processes with standard industrial classification (SIC) code 283.

SIC Code	SIC Description
2830	Drugs
2831	Biological Products
2833	Medicinals and Botanicals
2834	Pharmaceutical Preparations
2835	Diagnostic Substances
2836	Biological Production Excluding Diagnostics

The emissions for all pollutants for SIC Codes 2830 and 2831 are from the TRI database. The emission rates applied for SIC Codes 2833, 2834, 2835, and 2836 are from the “Basis and Purpose Document”. Any additional pollutants reported to TRI for these four SIC Codes were included.

References:

U. S. Environmental Protection Agency. Basis and Purpose Document - Pharmaceutical Production NESHAP. Research Triangle Park, North Carolina. January 1997. Document downloaded from Air CHIEF CD-ROM, June 10, 1997.

R. McDonald, U.S. EPA. Comments regarding hydrazine emissions from pharmaceutical production wastewater. February 11, 1999.

U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

	Process Vent Emissions (lb/year)	Storage Tank Emissions (lb/year)	Equipment Leak Emissions * (lb/year)	Waste Water Emissions (lb/year)	Total Emissions (lb/year)	Total Emissions (ton/year)
Methanol	4,200,105	128,185	3,167,913	29,136,677	36,632,880	**18,316.4**
N,N-dimethylformamide (and dimethylformamide)	1,112,153		838,837	4,571,456	6,522,446	**3,261.2**
Toluene	936,502	35,216	706,353	3,632,402	5,310,473	**2,655.2**
Hydrochloric acid	312,489	46,163	235,694		594,346	**297.2**
4-Methyl-2-pentanone (MIBK)	758,045		571,752	13,900	1,343,697	**671.8**
Hexane (and n-hexane)	332,341	29,201	250,667	1,838,778	2,450,987	**1,225.5**
Acetonitrile	136,594		103,025	926,804	1,166,423	**583.2**
Xylenes				724,196	724,196	**362.1**
Triethylamine	42,976		32,414	600,080	675,470	**337.7**
2-Butanone (MEK)	139,567		105,268	12,868	257,703	**128.9**
Carbon Disulfide	18,105		13,656	40,392	72,153	**36.1**
Methyl Chloroform	85,933		64,815		150,748	**75.4**
Chlorine	5,052		3,810		8,862	**4.4**
Phenol				357,533	357,533	**178.8**
Acetophenone				353,492	353,492	**176.7**
Chloroacetic acid				57,790	57,790	**28.9**
Ethylene glycol				45,545	45,545	**22.8**
Diethylaniline				38,311	38,311	**19.2**
Aniline				36,400	36,400	**18.2**
Epichlorohydrine				33,493	33,493	**16.7**
Chlorobenzene				10,959	10,959	**5.5**
Vinyl acetate				9,029	9,029	**4.5**
Chloromethyl methyl ether				4,600	4,600	**2.3**
Iodomethane (methyl iodide)				540	540	**0.3**
Methylene Chloride (dichloromethane)	7,787,829	496,917	0	8,076,206	16,360,952	**8,180.5**
Chloroform	234,990		177,240	402,025	814,255	**407.1**
Methyl chloride	264,194		199,267	194,604	658,065	**329.0**
Ethylene oxide	21,114		15,925	900	37,939	**19.0**
Trichloroethylene	150,300		113,363		263,663	**131.8**
Formaldehyde				702,230	702,230	**351.1**
1,2-Dichloroethane				482,499	482,499	**241.2**
Hydrazine				140	140	**0.07**
Benzene				1,700	1,700	**0.9**
1,2-Dibromoethane				100	100	**0.1**
Total emissions by process	16,538,289	735,682	6,600,000	52,305,649	76,179,620	28,429.0

<u>* EXAMPLE CALCULATION for Speciating Equipment Leak Emissions</u>

4,200,105 lbs Methanol from process vents / (16,538,289 lbs total HAPs - 7,787,829 lbs MeCl2)

= 0.48 lb methanol / lb total HAPs excluding Methylene Chloride

0.48 x 3000 Mg total HAPs / year x (2200 lbs / Mg) = 3,167,913 lbs / year Methanol from equipment leaks

Methodology:

The estimate comes directly from the 112(c)(6) report (1997).

The "Chemical Products Synopsis - Phthalic Anhydride", October 1990, reports that only one facility was using naphthalene to produce phthalic anhydride:

Koppers Industry, Cicero, IL
State FIP Code: 17
County FIP Code: 031.

Hence, all emissions of naphthalene for this source category are allocated to that one facility.

Data Qualifiers:
The 16-PAH emission factor was developed from individual PAH emission factors for storage and transfer of naphthalene used in the production of phthalic anhydride. The 16-PAH factor only includes naphthalene.

References:
U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM); 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) / 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs); Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997. pp. B-76.

Mannsville Chemical Products Corporation. Chemical Products Synopsis - Phthalic Anhydride. October, 1990.

Methodology:

Emissions data for Plastic Parts and Products Surface Coating (PPP) source category were obtained from the Toxic Release Inventory (TRI)[1]. Facilities reporting under the following SIC codes were used: 3086, 3089, 3537, 3571, 3573, 3577, 3578, 3579, 3643, 3647, 3711, 3713, 3714, 3715, 3716, 3751, 3799, 3821, 3931, 3942, 3944, 3949, 3961, 3993[2].

The Reinforced Plastic Composites (RPC) source category overlaps the source category Surface Coating of Plastic Parts and Products for several SIC Codes: 3089, 3647, 3711, 3713, 3714, 3715, 3716, 3799, 3821, 3949, and 3993. To prevent double counting, emissions for pollutants that were thought to be related to coating operations were allocated to the Plastic Parts and Products source category[3]. This list of coating related pollutants is as follows:

Benzene	Methanol	Polycyclic Organic Matter as 16-PAH
Ethylbenzene	Methyl Chloroform	Toluene
Ethylene Glycol	Methyl Ethyl Ketone	Trichloroethylene
Formaldehyde	Methyl Isobutyl Ketone	Xylene
Glycol Ethers	Methylene Chloride	

Because the Plastic Parts and Products Surface Coating source category addresses coating processes, any styrene and methyl methacrylate emissions reported for the overlapping SIC Codes were assumed to be related to fiberglassing operations and were allocated to the RPC source category[3].

References

1. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995. CD-ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

2. U.S. Environmental Protection Agency. Preliminary Industry Characterization: Surface Coating of Plastic Parts and Products. Research Triangle Park, North Carolina. September 1998.

3. Email from M. Strum, U.S. EPA/ESD, to Susan Buchanan, ERG. Questions on the MACT baseline inventory comments -Reply. December 4, 1998.

Methodology:

Summary of Emission Estimation Method for Polycarbonates Production

A 1993 base year estimate for polycarbonates production was provided by U.S. EPA/ESD. There were 5 facilities producing polycarbonate resins, which collectively emitted 9.9 tons of ethyl chloride and 20.7 tons of methylene chloride (Morris, 1998). No other hazardous air pollutants were emitted in quantifiable amounts.

Facility	Location	Ethyl Chloride Emissions	Methylene Chloride Emissions	State FIP	County FIP
Mobay Corp. (Bayer)	Baytown, TX	no data	4.0 tpy	48	201
GE Plastics	Pittsfield, MA	no data	14.0 tpy	25	003
Dow Chemical	Freeport, TX	no data	0.5 tpy	48	039
GE Plastics	Burkville, AL	no data	0.2 tpy	01	085
GE Plastics	Mt. Vernon, IN	9.9 tpy	2.0 tpy	18	129
TOTAL		9.9 tpy	20.7 tpy		

References:

1. Morris, M. U.S. Environmental Protection Agency, Emission Standards Division. HAP Emissions Information [for Polycarbonates Production] provided to Brian Hnat, Eastern Research Group, Inc. June 10, 1998.

Methodology:

The estimates for Polyether Polyols Production were provided by David Svensgaard U.S. EPA/OAQPS, June 12, 1998. There are four HAPs in which calculations were made: Propylene Oxide, Hexane, Toluene, and Ethylene Oxide.

<u>References</u>:

1. Svensgaard, D. U.S. Environmental Protection Agency, Emission Standards Division. HAP Emissions Information [for Polyether Polyols Production] provided to Brian Hnat, Eastern Research Group, Inc. June 12, 1998.

Methodology:

1992 base year estimates for Formaldehyde (600 tpy), Xylene (220 tpy), Methanol (235 tpy), and Phenol (205 tpy) from this subcategory were provided by U.S. EPA/ESD. There are over 100 facilities producing amino and/or phenolic resins (Schaefer, 1997).

Reference:

Schaefer, J. U.S. Environmental Protection Agency, Emission Standards Division. Personal communication with E. Paik, Eastern Research Group, Inc. Emission estimates and facility locations for Acetal, Amino and Phenolic Resins Production. July 18, 1997.

Methodology:

A 1992 base year estimate for this subcategory was provided by U.S. EPA/ESD. There are 3 facilities that produce acetal resins and emit formaldehyde (Schaefer, 1997):

Facility	Location	Emissions	State FIP	County FIP
Dupont	Parkersburg, WV	17.5 tpy	54	107
Hoechst Celanese	Bishop, TX	2.0 tpy	48	355
Ultraform	Theodore, AL	1.2 tpy	01	097
TOTAL		20.7 tpy		

There are 2 facilities that produce acetal resins and emit methanol (Schaefer, 1997):

Facility	Location	Emissions	State FIP	County FIP
Dupont	Parkersburg, WV	7.5 tpy	54	107
Hoechst Celanese	Bishop, TX	41.0 tpy	48	355
TOTAL		48.5 tpy		

References:

Schaefer, J. U.S. Environmental Protection Agency, Emission Standards Division. Personal communication with E. Paik, Eastern Research Group, Inc. Emission estimates and facility locations for Acetal, Amino and Phenolic Resins Production. July 18, 1997.

Methodology:

Approach:

National emissions were estimated by multiplying emission factors for polystyrene production by total national polystyrene production. The emission factors were obtained from the Styrene L&E (EPA, 1993). Total national polystyrene production was available for 1991 (McCaleb, 1993). It was assumed 1991 production did not differ significantly from 1990 production.

Data Qualifiers:

(1) Emission factors were only available for certain emission points, so this estimate may not include the entire amount of emissions from this source category.

(2) Emission factors were available only for uncontrolled operation, so this national estimate is for uncontrolled emissions. The control status overall or for individual facilities is not known, although the source category is likely regulated at the state and federal levels.

(3) In many cases, a range of emission factors for an emission point was published. The average of the range was used in calculations.

(4) Emission factors were available for both batch and continuous operation. The proportion of the two types of operation was not known, so it was assumed that both are used equally.

(5) Because facility-specific data are not available, the emissions allocated to specific counties may be an under- or over-estimate of actual emissions.

References:

U.S. Environmental Protection Agency. *Locating and Estimating Air Emissions from Sources of Styrene*. EPA-454/R-93-011. Research Triangle Park, North Carolina. April 1993. pp. 42-54.

McCaleb, K. E., ed. *Chemical Origins and Markets, Sixth Edition*. Chemical Marketing Research Center, SRI International. Menlo Park, CA. 1993. pp. 85-86.

Methodology:

Emission Factors for Polystyrene Production	(lb styrene/ton resin)			
	Range			Average
Continuous operation:				
Feed dissolver (mixing tank)		NA		0.018
Devolatilizer condenser vent	0.10	to	5.92	3.01
Styrene recovery unit condenser vent	0.10	to	0.26	0.18
Extruder quench vent	0.018	to	0.30	0.16
TOTAL Continuous Operation EF		NA		3.37
Batch operation:				
Reactor heading vent	0.3	to	2.7	1.50
Devolatilizer condenser vent	0.5	to	1.5	1.00
Extruder quench vent	0.30	to	0.60	0.45
TOTAL Batch Operation EF		NA		2.95

ACTIVITY DATA FOR POLYSTYRENE PRODUCTION

1991 Production (thousands)			metric tons	tons
Polystyrene Resins,		impact	808	889
"	"	straight	1068	1175
"	"	expandable bead	314	345
TOTAL				2409

TOTAL NATIONAL EMISSIONS OF STYRENE FROM POLYSTYRENE PRODUCTION

= (Total Continuous Operation EF * 1/2 Total resin produced)
+ (Total Batch Operation EF * 1/2 Total resin produced)
= (3.37 + 2.95) lb styrene/ton resin * (0.5 * 2,409,000) tons polystyrene resin
= 7,612,440 lb styrene
= <u>3806</u> <u>tons styrene from uncontrolled polystyrene production</u>

Methodology:

Summary of Emission Estimation Method for Polyvinyl Chloride and Copolymer Production

An emission factor for hydrogen chloride and vinyl chloride emissions from all polyvinyl production was developed by summing the controlled emission rates (lb/hr) given for dispersion, suspension, bulk, and solution polyvinyl chloride resin plants (Reference 1). The 1990 baseline estimate was then calculated by multiplying the controlled emission factors by an activity factor. An activity factor of 8000 operational hours per year was assumed.

Uncontrolled 1990 national emission estimates for 1,3-butadiene, chloroprene, and vinylidene chloride were developed by multiplying an emission factor by a national activity factor. Emission factors for these pollutants were taken from the US Environmental Protection Agency's FIRE System Database (Reference 2). The 1990 U.S. national activity factor used was 9,096 million pounds of polyvinyl chloride resin produced (Reference 3). These uncontrolled emission estimates were then corrected, based on the emission reductions targeted for vinyl chloride in the proposed emission standard supporting document (Reference 1), and engineering judgement. A reduction factor of 95% was applied to all uncontrolled estimates.

References:

1. U.S. Environmental Protection Agency. "Standard Support and Environmental Impact Statement: Emission Standard for Vinyl Chloride." Research Triangle Park, North Carolina. October 1975.

2. U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 6.01. Research Triangle Park, North Carolina. 1998.

3. The Society of the Plastics Industry, Inc. "Facts and Figures of the U.S. Plastics Industry." 1996.

Methodology:

TABLE 1: 1990 Hazardous Air Pollutant Emissions from Polyvinyl Chloride and Copolymer Production

Pollutant	Emission Factor (lb/ton PVC) (1)	Emission Factor (lb/hr) (2)	Control Reduction (2)	1990 PVC Production (millions of pounds) (3)	Annual Emissions (tons/year)
1,3-Butadiene	4.20E-04	--	0.95	9,096	4.78E-02
Chloroprene	8.00E-05	--	0.95	9,096	9.10E-03
Hydrogen Chloride	--	32.6	0.98	n/a	1.30E+02
Vinyl chloride	--	288	0.95	n/a	1.15E+03
Vinylidene chloride	1.80E-04	--	0.95	9,096	2.05E-02

References: (1) U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 6.01. Research Triangle Park, North Carolina. 1998.

(2) Based on engineering judgement and data available from: U.S. Environmental Protection Agency. "Standard Support and Environmental Impact Statement: Emission Standard for Vinyl Chloride." Research Triangle Park, North Carolina. October 1975.

(3) The Society of the Plastics Industry, Inc. "Facts and Figures of the U.S. Plastics Industry." 1996.

Methodology:

Portland Cement Non-Hazardous Waste-fired

1990 Estimates for Portland Cement Non-Hazardous Waste-Fired Operations were provided by Joe Wood, EPA/ESD. These estimates include:

Non-volatile HAP metals	160	tons/yr		
Mercury	4	tons/yr		
Hydrogen chloride	9,500	tons/yr		
Dioxin/furans	43	g (T E Q)/yr	=	4.74 E -05 tons (T E Q)/yr
Other organic HAPs	3,400	tons/yr		

Non-volatile HAP metals and other organic HAPs could not be associated with a specific pollutant, so they could not be included in this inventory.

References

U.S. EPA, Request for data from Barbara Driscol, U.S. EPA/OAQPS to Joe Wood, U.S. EPA/ ESD. *Portland Cement Manufacturing Industry MACT Source Category Emissions Estimates for 112K Purposes.* December 1997.

Methodology:

Estimates for the following two pollutants were taken from the Section 112(c)(6) report: Polycyclic Organic Matter as 16-PAH and Polycyclic Organic Matter as 7-PAH.

Hydrogen Fluoride Emissions**:**
Primary aluminum production rates were given for 23 model plants, representing 6 different types of primary aluminum production facilities (EPA, 1996). National baseline total fluoride (TF) emissions were calculated by applying emission factors to the model plant production rates. Emissions of gaseous fluoride (as HF) were calculated by multiplying the total fluoride emission estimates by a ratio of HF to TF, based on facility type. HF emission estimates were then summed across all production plant types to estimate national HF emissions. These estimates are approximations of nationwide emissions based on ratios of pollutants for a few plants.

The 1990 national emission estimate for HF was calculated to be 2476 tons/year.

The remaining HAP estimates for Primary Aluminum Production were taken from the TRI database SIC Code = 3334, SIC Description = Primary Aluminum.

<u>References:</u>

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

U.S. Environmental Protection Agency. “Primary Aluminum Industry: Technical Support Document for Proposed MACT Standards.” Office of Air Quality Planning and Standards, Emission Standards Division. July 1996.

U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

The mercury estimates were reported in the 112(c)(6) report.[1]

The remaining HAP estimates for Primary Battery, Dry and Wet Manufacture were taken from the TRI database based on the following SIC Code: 3692 (Primary Batteries, Dry And Wet).[2]

References

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetratchlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

1990 Base Year emission estimates for primary copper smelters were calculated by summing stack emissions data[1] and fugitive emissions data[2] for all eight primary copper facilities that were operating in 1990. The stack emissions data are actual emissions in 1992 whereas the fugitive emissions data are based on tests performed after 1992. The fugitive emissions data, provided by the EPA,[2] are the best available data to reflect fugitive emissions for Base Year 1990.

On the following page, Table 1 presents national stack emission estimates and Table 2 presents national fugitive emission estimates for primary copper smelters (8 facilities) operating in the United States. Table 3 presents total national emission estimates by pollutant, which were calculated by adding the stack emissions for a given pollutant to the respective fugitive emissions for the same pollutant.

An example calculation is as follows:

Arsenic total stack emissions (Table 1) =	35.72 Tons Per Year
Arsenic total fugitive emissions (Table 2) =	40.83 Tons Per Year
Total:	76.55 Tons Per Year

Therefore, the Base Year 1990 emission estimate for arsenic from primary copper smelters in the United States is 76.55 tons per year (Table 3).

Additional pollutants were added using data from the Toxic Release Inventory[3] (SIC = 3331). A list of facilities was provided to ERG in an EPA memorandum.[4] The following pollutants were added: Chlorine, Cresols, and Methyl Chloroform.

References

1. Final Summary Report: Primary Copper Smelters National Emission Standard for Hazardous Air Pollutants (NESHAP). U.S. EPA. July 1995.

2. Personal communication between Gene Crumpler (EPA/ESD) and Julie H. Tucker (Eastern Research Group, Inc.). July 1997.

3. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

4. Melton, Lula H., Metals Group, U.S. Environmental Protection Agency. "Response to Information Request", May 11, 1998.

Methodology:

Table 1: Total Stack Emission Estimates for Primary Copper Smelters

Primary Copper Smelter Facility (Facilities in United States in 1990)	Arsenic	Beryllium	Cadmium	Chromium	Lead	Manganese	Mercury	Nickel	Antimony	Selenium	Cobalt
	Total Stack Emissions by Pollutant (Tons Per Year)										
1. Asarco- El Paso	2.57	0.00	0.24	0.06	8.76	0.00	0.00	0.09	0.23	0.15	0.27
2. Asarco-Hayden	0.92	0.00	0.37	0.21	6.16	0.07	0.02	0.44	0.12	0.10	0.00
3. Copper Range	19.04	0.00	3.36	2.60	21.60	0.56	0.67	2.55	0.27	0.51	0.16
4. Cyprus-Miami	0.42	0.00	0.40	0.01	5.05	0.08	0.02	0.03	0.16	0.04	0.00
5. Kennecott- Utah	7.24	0.05	0.10	0.07	19.21	0.07	0.00	0.08	0.15	2.84	0.10
6. Magma-San Manuel	3.95	0.00	0.34	0.01	5.99	0.00	0.02	0.02	0.85	0.04	0.00
7. Phelps Dodge-Hurley	0.65	0.01	0.40	0.03	0.28	0.00	0.00	0.56	0.08	0.15	0.01
8. Phelps Dodge-Hidalgo	0.93	0.00	2.44	0.03	0.56	0.05	0.00	0.02	0.03	0.01	0.03
TOTAL:	35.72	0.06	7.65	3.02	67.61	0.83	0.73	3.79	1.89	3.84	0.57

NOTE:
Stack emissions data are from Table 6 in Reference 1. Stack emissions are based on actual 1992 emissions.
Reference 1: "Final Summary Report: Primary Copper Smelters National Emission Standard for Hazardous Air Pollutants (NESHAP)."EPA. July 1995.

Table 2: Total Fugitive Emission Estimates for Primary Copper Smelters

Primary Copper Smelter Facility (Facilities in United States in 1990)	Arsenic	Beryllium	Cadmium	Chromium	Lead	Manganese	Mercury	Nickel	Antimony	Selenium	Cobalt
	Total Fugitive Emissions by Pollutant (Tons Per Year)										
1. Asarco- El Paso	0.04	0.00	0.00	0.01	0.05	0.00	0.00	0.00	0.01	0.00	0.00
2. Asarco-Hayden	32.58	0.28	1.13	0.47	58.35	0.35	NR	0.61	1.70	23.53	0.32
3. Copper Range	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
4. Cyprus-Miami	0.21	0.00	1.68	0.09	12.61	0.00	0.00	1.68	0.84	0.21	0.00
5. Kennecott- Utah	1.36	0.01	0.05	0.02	2.92	0.02	0.00	0.02	0.03	0.37	0.03
6. Magma-San Manuel	4.46	0.00	1.07	0.00	3.97	0.01	0.01	0.00	1.59	2.12	0.00
7. Phelps Dodge-Hurley	1.12	0.00	4.20	NR	4.40	0.01	NR	0.25	0.01	0.05	0.03
8. Phelps Dodge-Hidalgo	1.06	NR	0.43	NR	2.54	0.02	NR	0.52	0.01	0.29	0.00
TOTAL:	40.83	0.29	8.56	0.59	84.84	0.41	0.01	3.08	4.19	26.57	0.38

NOTE:
NR= Emissions not reported
Fugitive emissions data provided by the EPA (Reference 2).
Reference 2: Personal Communication betw een Gene Crumpler (EPA/ESD) and Julie H. Tucker (Eastern Research Group, Inc.) July 1997.

Table 3: Base Year 1990 Emission Estimates for Primary Copper Smelters

Primary Copper Smelters (8 facilities)	Arsenic	Beryllium	Cadmium	Chromium	Lead	Manganese	Mercury	Nickel	Antimony	Selenium	Cobalt
	Nationw ide Emissions from Primary Copper Smelters (Tons/Year)										
Stack Emissions	35.72	0.06	7.65	3.02	67.61	0.83	0.73	3.79	1.89	3.84	0.57
Fugitive Emissions	40.83	0.29	8.56	0.59	84.84	0.41	0.01	3.08	4.19	26.57	0.38
Total Emissions	**76.55**	**0.35**	**16.21**	**3.61**	**152.45**	**1.24**	**0.74**	**6.87**	**6.08**	**30.41**	**0.95**

Methodology:

The mercury estimate was taken from the Section 112(c)(6) report.[1] For the rest of the pollutants, a facility list was provided by ESD[2], and the emission data were retrieved from the TRI database.[3]

References

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Cavender, K. Response to “Primary Lead Smelting Emissions request” sent by B. Kosmicki, Eastern Research Group, Inc. January 6, 1998.

3. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

HAP emissions for POTWs were calculated by adding the individual HAP emission totals for 19 potential major source POTWs to an estimate of the individual HAP emissions for the remaining area source POTWs. Emissions from POTWs considered to be potentially major sources were taken directly from an EPA memorandum.[1] In this memorandum,[1], HAP emissions data were provided for 19 POTWs that the Association of Metropolitan Sewerage Agencies (AMSA) has identified as potential major sources. HAP emissions were listed for each of the 19 POTWs based on their modeled influent concentrations; not every POTW has the same influent characteristics, therefore there is a different set of HAP estimates for each POTW. The major source POTWs only account for a portion of the total wastewater treated in the nation, therefore, another emissions estimation methodology was adopted for the remaining wastewater treated by area source POTWs.

In responding to a draft version of the Section 112(k) inventory, EPA provided technical comments on the estimation of POTW HAP emissions from area sources.[2] As part of that response, a memorandum[3] was provided that estimates national area source emissions from POTWs. The estimates provided in that memorandum were calculated using 1996 activity level data for the amount of wastewater treated. In order to better represent a 1990 base year, the area source POTW emissions provided in the memorandum were scaled back using a ratio of the amount of wastewater treated in 1992 (29,500 million gallons per day) as compared to the amount of wastewater treated in 1996 (32,175 million gallons per day). Both estimates of wastewater treated are based on national Needs Survey data and are cited in the two referenced memoradum.[3,4] The base year 1992 estimate was used since there is no Needs Survey estimate available for the 1990 base year.

Part 1 of spreadsheet below shows area source POTW emission estimates, scaled back to 1992. Part 2 of the spreadsheet shows 1992 emission estimates for the 19 major source POTWs and the total individual HAP emissions for this record, representing major source and area source POTWs. It should be noted that effluent concentrations vary significantly from community to community depending upon the industry discharges to the POTW. Therefore, these estimates only approximate actual emissions. The estimates given are on the national level; it is difficult to properly allocate these emissions to a single POTW due to the inherent differences between facilities.[5]

<u>References</u>

1. Memorandum from Calvin Overcash, EC/R Inc. to Bob Lucas, EPA/WCPG. “Review of Technical Information Regarding HAP Emissions and Control for Potential Major Sources in the Publicly Owned Treatment Works Source Category.” June 27, 1997.

2. Memorandum from Bob Lucas, EPA to Greg Nizich, EPA. “Review of Baseline Emission Inventory.” October 16, 1998.

3. Memorandum from Calvin Overcash, EC/R to Bob Lucas, EPA/WCPG. “Estimation of National Area Source Emissions from POTW.” August 20, 1998.

4. Letter from Prakasam Tata, AMSA to Anne Pope, EPA/EFIG. “Comments Regarding Section 112(k) - Urban Air Toxics Program Emissions Inventory for Publicly Owned Treatment Works (POTWs) and Sewage Sludge Incinerators.” October 15, 1997.

5. Telephone Conversation Between Bob Lucas, EPA and Regi Oommen, ERG. July 2, 1998.

APPENDIX A: NATIONAL ESTIMATES - Publicly Owned Treatment Works (POTW) Emissions

Methodology:

Part 1: Area Source POTW Emissions

General formula for calculation	1992 national HAP emissions = 1996 base year emissions * ratio of 1992/1996 wastewater treated
where:	
29,500	equals 1992 national wastewater treated at POTWs in millions of gallons per day
32,175	equals 1996 national wastewater treated at POTWs in millions of gallons per day
0.92	equals the ratio of 1992/1996 wastewater treated

Pollutant	1996 emissions (tpy)	1992 emissions (tpy)	Major component? (If so, see next page for total emissions. If not, then these emissions represent national estimates)
1,1,2,2-Tetrachloroethane	0.12	0.11	N
1,1,2-Trichloroethane	0.08	0.07	N
1,2,4-Trichlorobenzene	5.92	5.43	N
1,2-Dichloropropane	0.79	0.72	N
1,3-Butadiene	1.72	1.58	N
1,4-Dichlorobenzene	14.76	13.53	N
1,4-Dioxane	1.23	1.13	N
2,4-Dinitrotoluene	3.30	3.03	N
2-Nitropropane	0.02	0.02	N
Acetaldehyde	21.27	19.50	N
Acetonitrile	23.67	21.70	N
Acrolein	26.30	24.11	N
Acrylonitrile	26.56	24.35	Y
Allyl Chloride	1.33	1.22	N
Benzene	463.01	424.52	Y
Benzyl Chloride	0.56	0.51	N
Biphenyl	5.16	4.73	N
Carbon Disulfide	297.43	272.70	Y
Carbon Tetrachloride	77.35	70.92	N
Chlorobenzene	33.13	30.38	N
Chloroform	442.22	405.45	Y
Chloroprene	1.63	1.49	N
Cresol (mixed isomers)	0.11	0.10	N
Dimethyl Sulfate	0.09	0.08	N
Epichlorohydrin	0.31	0.28	N
Ethyl Acrylate	0.12	0.11	N
Ethyl Benzene	527.28	483.44	Y
Ethylene Oxide	15.22	13.95	N
Formaldehyde	1.35	1.24	N
Glycol Ethers	791.56	725.75	Y
Hexachloro-1,3,-Butadiene	0.05	0.05	N
Hexachlorocyclopentadiene	0.04	0.04	N
Methanol	785.16	719.88	Y
Methyl Chloroform	38.75	35.53	Y
Methyl Ethyl Ketone	195.83	179.55	Y
Methyl Isobutyl Ketone	185.08	169.69	Y
Methyl Methacrylate	21.31	19.54	N
Methyl Tert-Butyl Ether	4.37	4.01	N
N,N-Dimethylaniline	22.10	20.26	N
Naphthalene	90.00	82.52	N
Nitrobenzene	0.45	0.41	N
O-Toluidine	0.12	0.11	N
Propionaldehyde	0.24	0.22	N
Propylene Oxide	50.21	46.04	N
Styrene	187.99	172.36	Y
Tetrachloroethylene	293.47	269.07	Y
Toluene	842.39	772.35	Y
Trichloroethylene	21.05	19.30	Y
Vinyl Acetate	5.25	4.81	N
Vinyl Chloride	0.46	0.42	N
Vinylidene Chloride	29.01	26.60	N
Xylene	4,114.09	3,772.05	Y
Total:	**5,556.91**	**5,094.92**	

Methodology:

Part 2: Total Emissions by HAP for 19 Potential Major POTWs (tons/yr)

POTW ID	Acrylonitrile	Benzene	Carbon Disulfide	Chloroform	Ethyl Benzene	Glycol Ethers	Methanol	Methyl Chloroform
A								
B	1.26							
C		3.53				1.35	5.51	
D					3.1			
E								
F								
G		2.97	7.32			2.64		
H								
J						29.52	8.78	
K								
L				1.3				
M		8.24		1.69	1.39			1.7
N								
O				1.73				
P				2.01				1.82
Q				2.16				
S								
T			4.66	3.54	1.97	17.44		3.22
U		8.13		21.38	1.22			
Total Major	1.26	22.87	11.98	33.81	7.68	50.95	14.29	6.74
Total Area (from Part 1)	24.35	424.52	272.7	405.15	483.44	725.75	719.88	35.53
Total National Estimate	**25.61**	**447.39**	**284.68**	**438.96**	**491.12**	**776.70**	**734.17**	**42.27**

POTW ID	Methyl Ethyl Ketone	Methyl Isobutyl Ketone	Styrene	Tetrachloro-ethylene	Toluene	Trichloro-ethylene	Xylenes
A							
B			2.75				
C		4.83					2.74
D							31.05
E							
F					1.16		
G				1.34	3.59		3.67
H							
J	4.75						
K							
L				1.46	1.15		
M				1.58	15.3		3.26
N				1.25	1.16		
O					1.3		1.79
P				7.31			
Q					2.2		2.74
S					1.01		
T				9.13	8.15	2.75	9.85
U					8.86		
Total Major	4.75	4.83	2.75	22.07	43.88	2.75	55.1
Total Area (from Part 1)	179.55	169.69	172.36	269.07	772.35	19.3	3772.05
Total National Estimate	**184.30**	**174.52**	**175.11**	**291.14**	**816.23**	**22.05**	**3827.15**

Methodology:

A 1990 base year estimate for this source category was provided by U.S. EPA/ESD (Telander, 1997). There are 149 pulp and paper mills in the US with chemical recovery combustion sources that will be subject to Section 112 regulation.

Acetaldehyde	Manganese
Antimony	Mercury
Arsenic	Methanol
Benzene	Methyl Ethyl Ketone
Beryllium	Methyl Isobutyl Ketone
Cadmium	Nickel
Chromium	Phenol
Cobalt	Selenium
Formaldehyde	Styrene
Hydrochloric Acid	Toluene
Lead	Xylene

References:

Telander, J. U.S. Environmental Protection Agency, Emission Standards Division. Nationwide Baseline HAP Emission Estimates for MACT II--Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Semichemical Pulp Mills. Provided to E. Paik, Eastern Research Group, Inc. September 9, 1997.

Methodology:

The Acetaldehyde 1990 base year estimate for this source category was provided by U.S. EPA/ESD (Holloway, 1997). There are 124 pulp and paper mills in the US with kraft recovery combustion sources that will be subject to Section 112 regulation.

Polycyclic Organic Matter as 7-PAH, Polycyclic Organic Matter as 16-PAH, and Dioxins/Furans as 2,3,7,8-TCDD TEQ estimates were reported in the Section 112(c)(6) report (U.S. EPA, 1997).

References:

Holloway, T. MRI. Memo to B. Driscoll, U.S. Environmental Protection Agency, Emission Standards Division. "Nationwide Baseline Emission Estimates for 112(k) HAP's: NESHAP for Pulp and Paper Combustion Sources ("MACT II")." June 1997.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

A 1990 base year estimate for this source category was taken from the Section 112(c)(6)inventory effort (US EPA, 1997). There are 124 pulp and paper mills in the US with lime kilns. Emissions were spatially allocated according to the county proportion of national employment in SICs 261, 262, and 263 as follows:

County Emissions = (County SIC Employment / National SIC Employment) x National Emissions.

<u>References</u>:

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Emission Estimates for Pulp & Paper MACT I (non-combustion)

1996 emission estimates were provided in an October 7, 1997 memo to Penny Lassiter and Steven Shedd (EPA/OAQPS), “Summary of Database Outputs,” (Reference1). The emission estimates for non-chlorinated compounds provided in this memo were considered to be representative of the 1990 baseline. The 1996 emission estimates for chlorinated compounds were not considered to be representative of a 1990 baseline. This is due to the shift in production from Categories A and B mills (those with a hypochlorite stage, and those with no hypochlorite stage and low levels of chlorine dioxide substitution), to Category C mills (those with no hypochlorite stage and high levels of chlorine dioxide substitution) (References 2,3,4,5). To account for this industry change, an adjustment factor, based on the production ratios between categories A, B, and C for 1990 and 1996, and the chloroform emission factor for categories A, B, and C (Reference 6), was used to scale the 1996 chlorinated compound emissions to 1990. Since the emission factors for all chlorinated compounds are proportionate to chloroform (EPA 1997), the same adjustment factor is appropriate for any chlorinated compound.

The adjustment factor for chlorinated compounds was calculated as follows:

$$\frac{(P_{A96} * EF_A) + (P_{B96} * EF_B) + (P_{C96} * EF_C)}{(P_{A90} * EF_A) + (P_{B90} * EF_B) + (P_{C90} * EF_C)}$$

Where: P_{A96} = Percent of Total 1996 Industry Production, Category A
P_{A90} = Percent of Total 1990 Industry Production, Category A
P_{B96} = Percent of Total 1996 Industry Production, Category B
P_{B90} = Percent of Total 1990 Industry Production, Category B
P_{C96} = Percent of Total 1996 Industry Production, Category C
P_{C90} = Percent of Total 1990 Industry Production, Category C
EF_A = Chloroform Emission Factor, Category A
EF_B = Chloroform Emission Factor, Category B
EF_C = Chloroform Emission Factor, Category C

Example Calculations:

Non-chlorinated compounds:

Benzene: 56 Mg/yr * 1.102311 ton/Mg = 62 ton/yr

Chlorinated compounds:

Trichloroethylene: 477 Mg/yr * 1.102311 ton/Mg * 1/.644 = 816 ton/yr

References:

1. Memorandum from Greg DeAngelo (ERG) to Penny Lassiter (EPA/OAQPS) and Steven Shedd (EPA/OAQPS). October 7, 1998. “Summary of Database Outputs.”

2. Memorandum from Danny Greene (ERG) to Penny Lassiter (EPA/WCPG). February 29, 1996. “Baseline Level of Controls.” (Docket Number A-92-40, IV-B-8).

3. Memorandum from John Pinkerton (NCASI) to Penny Lassiter and Steven Shedd (EPA). June 7, 1996. Untitled. (Docket Number A-92-40, IV-D1-101).

4. 1990 National Census of Pulp, Paper, and Paperboard Manufacturing Facilities. OMB #2040-0144. (Docket Number A-92-40, II-A-36).

5. Miller Freeman. 1995. “1996 Lockwood Post’s Directory of Pulp, Paper, and Allied Trades.” (Docket Number A-92-40, IV-J-87).

6. US EPA. July 8, 1997. “Revised Draft: Chemical Pulping Emission Factor Development Document.” (Docket Number A-92-40 IV-A-8).

Methodology:

Methyl Chloride and Tetrachloroethylene estimates for the sulfite recovery process were provided by U.S. EPA/ESD (Holloway, 1997). There are 12 sulfite mills in the US with chemical recovery combustion sources that will be subject to Section 112 regulation. Because their capacities were not known, emissions were allocated equally to each of the mills.

Facility	Location	State FIP	County FIP
Badger Paper	Peshtigo, WI	55	075
Finch, Pruyn	Glens Falls, NY	36	113
Georgia-Pacific--Nekoosa Paper	Port Edwards, WI	55	141
Great Northern Paper	Millinocket, ME	23	019
ITT Rayonier	Fernandina Beach, FL	12	089
ITT Rayonier	Port Angeles, WA	53	009
James River	Camas, WA	53	011
Ketchikan Pulp	Ketchikan, AK	02	130
Procter & Gamble	Mehoopany, PA	42	131
Scott Paper	Everett, WA	53	061
Wausau Paper	Brokaw, WI	55	073
Weyerhaeuser Paper	Cosmopolis, WA	53	027

Refrences:
Holloway, T. MRI. Memo to B. Driscoll, U.S. Environmental Protection Agency, Emission Standards Division. "Nationwide Baseline Emission Estimates for 112(k) HAP's: NESHAP for Pulp and Paper Combustion Sources ("MACT II")." June, 1997.

Methodology:

The 1990 baseline emissions were taken from information collected in 1997 and provided by Susan Zapata, U.S. EPA/ESD, to Darcy Wilson, Eastern Research Group. The estimates for the Refractories Production source category do not include contribution from tar/pitch bonded refractories and unfired refractories with HAP raw materials. The information provided represented 95% of the total facilities in the U.S.

Pollutants estimated from this source category:

Chromium
Ethylene Glycol
Formaldehyde
Hydrochloric Acid
Hydrogen Fluoride
Methanol
Phenol

<u>Reference:</u>
Zapata, Susan, U.S. EPA/ESD. Personal communication to Darcy Wilson, Eastern Research Group, “Refractories and Friction Products Manufacturing,” July 17, 1998.

Methodology:

Emissions data for Reinforced Plastic Composites Production (RPC) were obtained from the Toxic Release Inventory (TRI)[1]. Based on guidance from the U.S. EPA[2], TRI was searched for data from facilities that report under SIC Codes 2434, 2519, 2522, 2541, 2599, 2821, 3079, 3082, 3083, 3084, 3087, 3088, 3089, 3281, 3296, 3299, 3431, 3499, 3531, 3533, 3546, 3561, 3564, 3589, 3612, 3613, 3621, 3647, 3663, 3679, 3711, 3713, 3714, 3715, 3716, 3728, 3743, 3792, 3799, 3821, 3949, 3993, and 3999. A number of adjustments were made.

Facilities that were believed to be manufacturers of styrene or the polyester resin itself were identified in part by reviewing the U.S. EPA's document: *Locating and Estimating Air Emissions from Sources of Styrene*[3]. These were removed from the TRI data. Facilities that did not report emissions of styrene were not included in the estimates.

The RPC source category overlaps the source category Surface Coating of Plastic Parts and Products for several SIC Codes: 3089, 3647, 3711, 3713, 3714, 3715, 3716, 3799, 3821, 3949, and 3993. To prevent double counting, emissions for the list of pollutants that were thought to be related to coating operations were allocated to the Plastic Parts and Products source category (see pollutants with asterisk in list below).

Because the Plastic Parts and Products Surface Coating source category addresses coating processes, any styrene and methyl methacrylate emissions reported for the SIC Codes unique to the Plastic Parts and Products Surface Coating source category were assumed to be related to fiberglassing operations and were allocated to the RPC source category.

For styrene and methyl methacrylate emissions, ESD instructed ERG to double the TRI emissions.[4-5] The remaining HAPs estimated were taken directly from TRI without any adjustments:

1,3-Butadiene	Cyanide	Methanol*
4,4'-Methylenedianiline	Diethanolamine	Methyl Chloroform*
Acrylic Acid	Dimethyl Phthalate	Methyl Ethyl Ketone*
Acrylonitrile	Epichlorohydrin	Methyl Isobutyl Ketone*
Antimony	Ethyl Acrylate	Methylene Chloride*
Benzene*	Ethylbenzene*	Methylene Diphenyl Diisocyante
bis(2-ethylhexyl)phthalate	Ethylene Glycol*	Nickel
Chlorine	Formaldehyde*	Phenol
Chlorobenzene	Glycol Ethers*	Phthalic Anhydride
Chloroform	Hydrochloric Acid	Polycyclic Organic Matter as 16-PAH*
Chromium	Hydrogen Fluoride	Propylene Oxide
Cresols	Lead	Toluene*
Cumene	Maleic Anhydride	Trichloroethylene*
	Manganese	Xylene*

* HAPs associated with coating that were allocated to the Plastic Parts and Products source category[5].

References

1. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995. CD-ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

2. Strum, M. U.S. Environmental Protection Agency, Emission Standards Division. Personal communication with D. Wilson, Eastern Research Group, Inc. Guidance on developing HAP emission estimates for the Reinforced Plastic Composites Production source category.

3. U. S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Styrene. Research Triangle Park, North Carolina. April 1993. EPA-454/R-93-011.

4. Email from M. Strum to D. Wilson. Re: Emission Inventory Efforts. July 28, 1998.

5. Email from M. Strum, U.S. EPA/ESD to Susan Buchanan, ERG. Questions on the MACT baseline inventory comments -Reply. December 4, 1998.

Methodology:

The number of facilities is unavailable.

The activity comes from the 112(c)(6) report (U.S. EPA, 1997).

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. These emission factors are from 10 facilities firing bituminous, 8 facilities firing subbituminous, and 1 facility firing lignite. Factors apply to boilers utilizing both wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator or fabric filter:

Acetaldehyde	Bis(2-ethylhexyl) Phthalate	Methyl Chloride	Styrene
Acrolein	Ethylene Dichloride	Methylene Chloride	Tetrachloroethylene
Benzene	Formaldehyde		

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, and nickel. These emission factors are from 11 facilities firing bituminous, 15 facilities firing subbituminous, and 2 facilities firing lignite. Factors apply to boilers utilizing either venturi scrubbers, spray dryer absorbers, or wet limestone scrubbers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator, fabric filter, or venturi scrubber.

The Emission Standards Division {Porter, 1998} supplied emission factors for dioxins/furans (as toxic equivalency units) and POM as 16-PAH.

The emission factor for POM as 7-PAH was calculated using the emission factors for benz[a]anthracene, benzo[b,j,k]fluoranthene, benzo[a]pyrene, chrysene, and indeno[1,2,3-c,d]pyrene provided in AP-42 {US EPA, 1996}. These emission factors are from six sites firing bituminuous coal, four sites firing subbituminous coal, and one site firing lignite. Factors apply to boilers using either wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers using only an electrostatic precipitator or fabric filter. The emission factor for POM as EOM of 1.35 pound per short ton of coal was obtained from the 112(c)(6) report {US EPA, 1997}.

<u>References</u>:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Residential Anthracite Coal Combustion, 1990

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1) (tons coal burned/year)	National Emissions (tons/year)
acetaldehyde	5.7E-04	Reference 2, 3	7.32E+05	2.09E-01
acrolein	2.9E-04	Reference 2, 3	7.32E+05	1.06E-01
arsenic	4.1E-04	Reference 2, 3	7.32E+05	1.50E-01
benzene	1.3E-03	Reference 2, 3	7.32E+05	4.76E-01
beryllium	2.1E-05	Reference 2, 3	7.32E+05	7.69E-03
bis(2-ethylhexyl)phthalate	7.3E-05	Reference 2, 3	7.32E+05	2.67E-02
cadmium	5.1E-05	Reference 2, 3	7.32E+05	1.87E-02
chromium	2.6E-04	Reference 2, 3	7.32E+05	9.52E-02
dioxins/furans (TEQ units)	3.5E-12	Reference 2	7.32E+05	1.28E-09
ethylene dichloride	4.0E-05	Reference 2, 3	7.32E+05	1.46E-02
formaldehyde	2.4E-04	Reference 2, 3	7.32E+05	8.78E-02
lead	4.2E-04	Reference 2, 3	7.32E+05	1.54E-01
manganese	4.9E-04	Reference 2, 3	7.32E+05	1.79E-01
mercury	8.3E-05	Reference 2, 3	7.32E+05	3.04E-02
methyl chloride	5.3E-04	Reference 2, 3	7.32E+05	1.94E-01
methylene chloride	2.9E-04	Reference 2, 3	7.32E+05	1.06E-01
nickel	2.8E-04	Reference 2, 3	7.32E+05	1.02E-01
POM as 7-PAH	3.9E-07	Reference 3	7.32E+05	1.42E-04
POM as 16-PAH	1.9E-05	Reference 2	7.32E+05	6.95E-03
POM as EOM	1.35E+00	Reference 1	7.32E+05	4.94E+02
styrene	2.5E-05	Reference 2, 3	7.32E+05	9.15E-03
tetrachloroethylene	4.3E-05	Reference 2, 3	7.32E+05	1.57E-02

Example Calculation:

National emissions (tons/year) = Emission Factor (lb/ton) x National Activity Level (tons/year)/2,000 lb/ton

National acetaldehyde emissions = 0.00057 x 732000/2000 = 0.209 tons/year

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating and Cooling information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

The number of facilities is unavailable.

The activity comes from the 112(c)(6) report (U.S. EPA, 1997).

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for the following HAPs. These emission factors are from 10 facilities firing bituminous, 8 facilities firing subbituminous, and 1 facility firing lignite. Factors apply to boilers utilizing both wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator or fabric filter:

Acetaldehyde	Bis(2-ethylhexyl) Phthalate	Methyl Chloride	Styrene
Acrolein	Ethylene Dichloride	Methylene Chloride	Tetrachloroethylene
Benzene	Formaldehyde		

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, and nickel. These emission factors are from 11 facilities firing bituminous, 15 facilities firing subbituminous, and 2 facilities firing lignite. Factors apply to boilers utilizing either venturi scrubbers, spray dryer absorbers, or wet limestone scrubbers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator, fabric filter, or venturi scrubber.

The Emission Standards Division {Porter, 1998} supplied emission factors for dioxins/furans (as toxic equivalency units) and POM as 16 PAH.

The emission factor for POM as 7 PAH was calculated using the emission factors for benz[a]anthracene, benzo[b,j,k]fluoranthene, benzo[a]pyrene, chrysene, and indeno[1,2,3-c,d]pyrene provided in AP-42 {US EPA, 1996}. These emission factors are from six sites firing bituminuous coal, four sites firing subbituminous coal, and one site firing lignite. Factors apply to boilers using either wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers using only an electrostatic precipitator or fabric filter. The emission factor for POM as EOM of 1.35 pound per short ton of coal was obtained from the 112(c)(6) report {US EPA, 1997}.

<u>References</u>:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Nationwide Emissions from Residential Bituminous and Lignite Coal Combustion, 1990

Pollutant	Emission Factor (lb/ton coal)	Emission Factor Reference	National Activity Level (Reference 1) (tons coal burned/year)	National Emissions (tons/year)
acetaldehyde	5.7E-04	Reference 2, 3	1.93E+06	5.50E-01
acrolein	2.9E-04	Reference 2, 3	1.93E+06	2.80E-01
arsenic	4.1E-04	Reference 2, 3	1.93E+06	3.96E-01
benzene	1.3E-03	Reference 2, 3	1.93E+06	1.25E+00
beryllium	2.1E-05	Reference 2, 3	1.93E+06	2.03E-02
bis(2-ethylhexyl)phthalate	7.3E-05	Reference 2, 3	1.93E+06	7.04E-02
cadmium	5.1E-05	Reference 2, 3	1.93E+06	4.92E-02
chromium	2.6E-04	Reference 2, 3	1.93E+06	2.51E-01
dioxins/furans (TEQ units)	3.5E-12	Reference 2	1.93E+06	3.38E-09
ethylene dichloride	4.0E-05	Reference 2, 3	1.93E+06	3.86E-02
formaldehyde	2.4E-04	Reference 2, 3	1.93E+06	2.32E-01
lead	4.2E-04	Reference 2, 3	1.93E+06	4.05E-01
manganese	4.9E-04	Reference 2, 3	1.93E+06	4.73E-01
mercury	8.3E-05	Reference 2, 3	1.93E+06	8.01E-02
methyl chloride	5.3E-04	Reference 2, 3	1.93E+06	5.11E-01
methylene chloride	2.9E-04	Reference 2, 3	1.93E+06	2.80E-01
nickel	2.8E-04	Reference 2, 3	1.93E+06	2.70E-01
POM as 7-PAH	3.9E-07	Reference 3	1.93E+06	3.75E-04
POM as 16-PAH	1.9E-05	Reference 2	1.93E+06	1.83E-02
POM as EOM	1.35E+00	Reference 1	1.93E+06	1.30E+03
styrene	2.5E-05	Reference 2, 3	1.93E+06	2.41E-02
tetrachloroethylene	4.3E-05	Reference 2, 3	1.93E+06	4.15E-02

Example Calculation:

National emissions (tons/year) = Emission Factor (lb/ton) x National Activity Level (tons/year)/2,000 lb/ton

National acetaldehyde emissions = 0.00057 x 1930000/2000 = 0.550 tons/year

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Commercial/Institutional Heating and Cooling information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

10.1e6 homes use distillate fuel as their primary heat source (U.S. EPA, 1997).

The activity comes from the Section 112(c)(6) report (U.S. EPA, 1997).

The EPA Emission Standards Division (Porter, 1998) supplied emission factors based on AP-42 (EPA, 1998) for benzene, formaldehyde, and POM as 16-PAH. Data are for residual oil fired boilers. POM as 16-PAH was calculated by summing the emission factors for fifteen PAH (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b,k) fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene). The formaldehyde emission factor is based only on data from utilities using No. 6 oil. The higher heating value for distillate oil comes from the Emission Standards Division (Porter, 1998).

The Emission Standards Division (Porter, 1998) supplied emission factors based on AP-42 (EPA, 1998) for arsenic, beryllium, cadmium, chromium, lead, manganese, mercury, and nickel. Data are for residual oil fired boilers. Eighteen out of 19 sources were uncontrolled and 1 source was controlled with a low efficiency electrostatic precipitator.

The Emission Standards Division (Porter, 1998) also supplied an emission factor for acetaldehyde. An emission factor for POM as 7-PAH was taken from AP-42 (EPA, 1998).

<u>References</u>:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1998.

APPENDIX A: NATIONAL ESTIMATES - Residential Heating: Distillate Oil Combustion

Methodology:

Nationwide Emissions from Residential Distillate Oil Combustion, 1990

Pollutant	Emission Factor (lb/MM Btu Oil)	Emission Factor Reference	National Activity Level (Reference 1, 2) (MM Btu oil burned/year)	National Emissions (tons/year)
acetaldehyde	3.5E-05	Reference 2	8.46E+08	1.48E+01
arsenic	4.0E-06	Reference 2, 3	8.46E+08	1.69E+00
benzene	1.5E-06	Reference 2, 3	8.46E+08	6.34E-01
beryllium	3.0E-06	Reference 2, 3	8.46E+08	1.27E+00
cadmium	3.0E-06	Reference 2, 3	8.46E+08	1.27E+00
chromium	3.0E-06	Reference 2, 3	8.46E+08	1.27E+00
formaldehyde	2.4E-04	Reference 2, 3	8.46E+08	1.01E+02
lead	9.0E-06	Reference 2, 3	8.46E+08	3.81E+00
manganese	6.0E-06	Reference 2, 3	8.46E+08	2.54E+00
mercury	3.0E-06	Reference 2, 3	8.46E+08	1.27E+00
nickel	3.0E-06	Reference 2, 3	8.46E+08	1.27E+00
POM as 16-PAH	8.4E-06	Reference 2, 3	8.46E+08	3.55E+00
POM as 7-PAH	8.3E-08	Reference 3	8.46E+08	3.53E-02

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Conversion of Activity level in gallons to MM Btu

Activity level, gallons =	6.04E+09	gallons/year		
		higher heating value =	1.40E+05	Btu/gallon
		MM Btu =	1.00E+06	Btu
Activity level, MM Btu =		8.46E+08	MM Btu/yr	

Methodology:

The number of facilities is unavailable.

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1998} for benzene, formaldehyde, and POM as 16-PAH. Data are for all natural gas combustion sources. POM as 16-PAH was calculated by summing the emission factors for the five PAH (fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene) which had emission factors reported above the method detection limit. The higher heating value for natural gas was supplied by the emissions standards division {Porter, 1998}.

The Emission Standards Division {Porter, 1998} also supplied an emission factor for acetaldehyde.

Activity data were taken from the State Data Energy Report (U.S. DOE, 1992).

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1998.

3. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, DC. pp 39-344, 1992.

Methodology:

Nationwide Emissions from Residential Natural Gas Combustion, 1990

Pollutant	Emission Factor (lb/MM Btu NG)	Emission Factor Reference	National Activity Level (Reference 1) (MM Btu NG burned/year)	National Emissions (tons/year)
acetaldehyde	1.3E-08	Reference 2	4.30E+09	2.80E-02
benzene	2.1E-06	Reference 2, 3	4.30E+09	4.52E+00
formaldehyde	7.5E-05	Reference 2, 3	4.30E+09	1.61E+02
POM as 16-PAH	6.4E-07	Reference 2, 3	4.30E+09	1.38E+00

References:
1. Energy Information Administration (EIA). State Energy Data Report. Office of Energy Markets and End Use, U.S. Department of Energy, Washington, D.C. pp 39 - 344, 1992.
2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
3. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42 Update, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina.

Conversion of Activity level in Btu to MM Btu

Activity level, btu =	4.30E+15	Btu/yr		
		MM btu =	1.00E+06	Btu
Activity level, MM Btu =		4.30E+09	MM Btu/yr	

Methodology:

Based on the U. S. Department of Energy (DOE)[1] and other survey data[2-5] there were an estimated 25 million residential wood burning appliances in use in 1990. Of these, about 16 million were fireplaces, 9 million were wood stoves. Of the 9 million wood stoves about 8.5 million were conventional non-certified wood stoves, 0.5 million were certified. Several variables affect emissions. Hundreds of types of wood burning appliances are in use and dozens of tree species are used for fuel. Others include: draft characteristics (chimney conditions), altitude, fuel wood seasoning and storage practices (wood moisture), and operation of wood burning devices (burn rate, burn duration, fuel size, damper setting and kindling approach). The wide range of combustion conditions and the substantial differences in fuel chemistry cause emissions to vary significantly from appliance to appliance.

Woodstove controls include catalytic converters which control emissions in the same way as on an automobile and non-catalytic controls which use secondary combustion chambers and baffles.[6]

Nationally, residential wood consumption for fireplaces is 28% and 72% for woodstoves. [7] Based on Hearth Products Association surveys and a survey conducted by the DOE, estimated relative woodstove appliance usage for 1990 is as follows: non-certified conventional woodstoves, 95%, combined certified non-catalytic and catalytic stoves, 5%. Of the 5% that are certified stoves, the breakdown between non-catalytic and catalytic is 50:50.[8]

EPA supplied emission factors for formaldehyde, arsenic, cadmium, chromium, lead, mercury, and manganese[9] based on information in the AP-42 database.[10] The conversion factor of 4500 Btu/lb fuel burned is also taken from AP-42.[10] All emission factors are for uncontrolled combustors. EPA[10] also supplied emission factors for POM as 16 PAH, dioxin/furan in toxic equivalency units, and nickel.

<u>References</u>:

1. U.S. Department of Energy, Energy Information Administration, 1993, Household Energy Consumption and Expenditures 1990, DOE/EIA-0321(90).
2. Simmons Market Research Bureau, Inc., 1990, The 1990 Study of Media and Markets.
3. Mediamark Research Inc., 1989, Medimark Research, Household & Personal Appliances, Etc. Report.
4. U.S. Consumer Product Safety Commission, 1989, Room Heating Equipment Exposure Survey, Final Report, OMB control no. 3041-0083.
5. Smith, Bucklin & Associates, Inc., Market Research & Statistics Division, 1992, The1991 Confidential Manufacturing Study, EPA Certified Cord Wood Burning Appliances, report to Hearth Products Association, Arlington, VA.
6. U.S. Environmental Protection Agency. National Urban Area Source Emissions of Benzene, 1,3-Butadiene, Formaldehyde, Trichloroethylene, Perchloroethylene, Methylene Chloride, and Carbon Tetrachloride. Final Report. Research Triangle Park, North Carolina. March 1996.
7. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.
8. Memorandum from Jim Houck, OMNI Environmental Services, Inc., to Adam Langmaid, Eastern Research Group. July 8, 1997. Wood burning appliance use base year 1990.
9. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Industrial Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September18, 1998. November 13, 1998.
10. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

Methodology:

Activity:	**3.38E+07**	**ton from residential sector in 1990**	
		Estimate	**Estimate**
Pollutant Name	**Factor (lb/ton)**	**(tons/yr)**	**(lb./yr)**
Arsenic & Compounds (inorganic including Arsine)	8.50E-05	1.44E+00	2.87E+03
Cadmium and Compounds	2.10E-05	3.55E-01	7.10E+02
Chromium and Compounds	1.60E-04	2.70E+00	5.41E+03
Dioxins/Furans (as TEQ units)	2.50E-09	4.23E-05	8.45E-02
Formaldehyde	8.20E-03	1.39E+02	2.77E+05
Lead and Compounds	4.50E-04	7.61E+00	1.52E+04
Manganese and Compounds	1.30E-02	2.20E+02	4.39E+05
Mercury and Compounds	5.20E-06	8.79E-02	1.76E+02
Nickel and Compounds	2.10E-05	3.55E-01	7.10E+02
POM as 7 PAH	3.31E-05	5.60E-01	1.12E+03
POM as 16 PAH	3.50E-03	5.92E+01	1.18E+05

Sample calculation:

0.000085 lb. Arsenic	3.38 e+7 tons of wood/wood residue	1 ton Arseinic
ton of wood/wood waste burned with 50 % moisture		2000 lb. Arsenic

Methodology:

The emission estimates for Dioxin/Furan, Polychlorinated Biphenyls, Polycyclic Organic Matter as 7-PAH, and Polycyclic Organic Matter as 16-PAH were taken from the 112(c)(6) report (U.S. EPA, 1997). The emission factors used to make the estimate are representative of a tire-to-energy facility with a spray dryer and flue gas desulfurization followed by a fabric filter to control emissions. In 1990 there were 18 facilities.

References

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Cadmium and formaldehyde emissions for secondary aluminum smelting were estimated using emission factors from EPA's FIRE database.[1] These factors represent emissions from the burning and drying operations associated with the processing of scrap aluminum cans. There are other processes involved in secondary aluminum production for which no factors were available. Cadmium emission factors were available for three different control configurations: venturi scrubber, multiple cyclone, and baghouse. The formaldehyde emission factor represents a unit with multiple cyclones.

An estimate of 1.4 million tons of used aluminum beverage cans processed in 1989 was used in estimating national emissions and was obtained from AP-42.[2]

Estimates for dioxins/furans as 2,3,7,8-TCDD TEQ come from the Section 112(c)(6) report.[3]

Lead emissions were taken directly from the lead Locating and Estimating document.[4]

References:

1. U.S. Environmental Protection Agency. Factor Information Retrieval (FIRE) System Database, Version 5.1a. Research Triangle Park, North Carolina. September 1995.

2. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition and Supplements, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

3. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

4. U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Lead and Lead Compounds. Draft Report. Research Triangle Park, North Carolina. July 1996.

Methodology:

All factors in units of lb of pollutant/lb cans processed

Pollutant	Factor	Factor	Factor	Avg. Factor
Cadmium	1.14E-08	1.40E-09	3.72E-08	1.67E-08
Formaldehyde	1.38E-07			1.38E-07

Calculate national emissions:

1989 national activity level: 1.4 million tons of cans recycled

2800000000 lbs of cans recycled

Pollutant	lb/yr	tons/yr
Cadmium	46.67	0.023
Formaldehyde	386.40	0.193

Methodology:

National cadmium emission estimates for Secondary Copper Smelting in 1990, along with the number of facilities, are documented in the Locating and Estimating document for cadmium and cadmium compounds.[1]

Emission estimates for dioxins/furans as 2,3,7,8-TCDD TEQ were obtained from the Section 112(c)(6) report.[2]

Lead emissions from secondary copper production were taken from Reference 3.

References:

1. U.S. Environmental Protection Agency. September 1993. Locating and Estimating Air Emissions from Sources of Cadmium and Cadmium Compounds. EPA-452/R-93-040.

2. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

3. U.S. Environmental Protection Agency. National Air Pollution Emission Trends, 1990-1994. Research Triangle Park, North Carolina. EPA-454/R-95-011. October, 1995.

Methodology:

Dioxin/Furan Estimates are from the 112(c)(6) report (US EPA, 1997)

The following HAP estimates were provided by ESD (Cavender, 1997):

1,1,2,2-Tetrachloroethane
1,3-Butadiene
1,3-Dichloropropane
Acetaldehyde
Acetophenone
Acrolein
Acrylonitrile
Antimony
Arsenic
Benzene
Biphenyl
bis(2-ethylhexyl)phthalate
Cadmium
Carbon Disulfide
Chlorobenzene
Chloroform
Chromium
Cumene
Dibutyl Phthalate
Ethyl Carbamate
Ethylbenzene
Formaldehyde
Hexane
Lead
Manganese
Mercury
Methyl Bromide
Methyl Chloride
Methyl Ethyl Ketone
Methyl Iodide
Methylene Chloride
Nickel
Phenol
Polycyclic Organic Matter as 16-PAH
Propionaldehyde
Styrene
Toluene
Trichloroethylene
Xylene

References

Cavender, K. U.S. Environmental Protection Agency, Emission Standards Division. Information on secondary lead smelting facilities provided to J. Johnson, Eastern Research Group, Inc. July 1997.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Secondary Mercury

In 1990, there were four secondary mercury plants operating in the U.S.[1] Two of the four plants reported to TRI[2] and the reported data were used in this inventory. For the remaining plants, it was assumed, based on other work performed by EPA,[3] that their emissions would be similar to those from the Mercury Refining Company in Latham, NY.

REFERENCES

1. U.S. Environmental Protection Agency/ Office of Research and Development and Office of Air Quality Planning and Standards. Mercury Report to Congress, Volume II: An Inventory of Anthropogenic Mercury Emissions in the United States - SAB Review Draft. EPA 452/R-96-001b. Research Triangle Park, North Carolina. June 1996.

2. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1994 CD ROM (1990 Data). EPA 749-C-96-003. Research Triangle Park, North Carolina. August 1996.

3. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Secondary Mercury Production			
	Location		Mercury
Facilities	City	State	Emissions (T
Bethlehem Apparatus	Hellertow n	PA	0.0025
Mercury Refining Co	Latham	NY	0.25
Adrow Chemical Co*	Wanaque	NJ	0.25
DF Goldsmith*	Evanston	IL	0.25
Total			0.7525
* = Assumed mercury emissions w ere similar to Mercury Refining Co.			

Methodology:

See Calculations

The number of facilities and emissions data used to calculate national emissions are documented in the reference cited below.

References:

U.S. Environmental Protection Agency. September 1993. Locating and Estimating Air Emissions from Sources of Cadmium and Cadmium Compounds. EPA-454/R-93-040.

Methodology:

Emission estimates for "Secondary Zinc from Metallic Scrap", which are documented in the 1993 Cadmium L& E (see above), are used to calculate national Cadmium emission estimates for "Secondary Zinc Production."

Source Category	National Cadmium Emissions	Units
Secondary Zinc From Metallic Scrap (13 facilities)	1,500	kg/year
Total:	1,500	kg/year
Convert from kg/year to tons/year:	1.65	kg/yr * 2.2 lbs/kg * ton/2000 lbs
Secondary Zinc Production Total:	**1.65**	**tons/year**

Methodology:

The Dioxin/Furan, Mercury, Polychlorinated Biphenyls, Polycyclic Organic Matter as 7-PAH and Polycyclic Organic Matter as 16-PAH estimates are taken directly from the Section 112(c)(6) report.[1] The remaining HAPs for Sewage Sludge Incineration were calculated using an emission factor from AP-42.[2]

The reference for the number of facilities came from Gene Crumpler.[3] The total activity level comes from a Federal Register notice.[4] Survey results indicated that approximately 98% of all Sewage Sludge Incinerators are controlled, with the controls being venturi scrubbers (VS), cyclone scrubbers (CS), impingement tray scrubbers (IS), afterburners (AB), electrostatic precipitators (ES), and/or a combination of these.[5] Therefore, all the emission factors used for Sewage Sludge Incineration calculations will be for those control devices. Based on the survey, weighting factors for the various control device scenarios were established.

Approximately 80% of the furnaces are multiple-hearth, 15% are fluidized bed, and 3% are electric infrared furnaces. Emission factors are available for a number of the inventory pollutants for multiple-hearth furnaces. There are no emission factors, however, for electric infrared furnaces in AP-42, and few for fluidized bed. Since Multiple-Hearth and Fluidized Bed are the most common furnaces (95% of the total), only those factors are used. The new weighting schemes are as follows:

Multiple-Hearth:	[80% x (100/95)] = 84.21 %
Fluidized Bed:	[15% x (100/95)] = 15.79 %

The emissions estimated are based upon available emission factors for the various control scenarios identified in the PES survey,[5] and with the above furnace weighting percentages. If, however, there is/are pollutant emission factor(s) only available for a multiple-hearth furnace, then that/those factor(s) will be used to represent emissions for the applicable pollutant(s) for the entire source category (i.e., all activity will be assigned to the multiple-hearth furnace configuration).

Control factors were applied for the following scenarios: VS; CS; CS/VS/IS; IS; VS/IS; VS/CS; VS/IS/AB; and VS/IS/ES. However, emission factors for each of the pollutants were not available for all of these control scenarios. That is, one pollutant may have emission factors for 3 of the above control scenarios, while another may have emission factor for 5 of the control scenarios. Depending on the number of emission factors available for a particular pollutant, those factors are weighted according to relative populations of the corresponding control scenarios in the PES survey. For pollutants where a full set of emission factors was not available to represent every control scenario in the PES survey, the relative weighting factors were adjusted to account for 100% of the activity data.

References:

1. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

2. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1995.

3. Crumpler, G. U.S. Environmental Protection Agency. Emission Standards Division. List of Part 503 Sewage Sludge Incinerators. Provided to D. Wilson, Eastern Research Group, Inc. January 8, 1997.

4. Federal Register. February 19, 1993. Standards for the Use or Disposal of Sewage Sludge; Final Rules. F.R. 58:9248-9404.

5. Pacific Environmental Services (PES). Sewage Sludge Permit 503 Applications Database, Draft Version. November 20, 1997.

Methodology:

Calculating national emissions of 1,1,2,2-Tetrachloroethane								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	100							
Fluidized Bed	0							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS),								
Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as								
control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge								
Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled								
Controlled-VS	2.40E-02							
Controlled-CS								
Controlled-CS/VS/IS								
Controlled-IS								
Controlled-VS/IS								
Controlled-VS/CS								
Controlled-VS/IS/AB								
Controlled-VS/IS/ES								
Average weighted controlled	2.40E-02		22331.50				0.00	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**22331.50**		Total Emissions (lb/yr)		**0.00**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	22331.50	X	100.00	+	0.00	X	0	
Total Emissions (lb/yr)	22331.495							
Total Emissions (tpy)	11.165748							

Methodology:

Calculating national emissions of 1,4-Dichlorobenzene							
Activity Level =		8.647E+05	metric tons/yr				
Adjusted Percentages							
Furnace Type	% in use						
Multiple Hearth	84.21						
Fluidized Bed	15.79						
	Convert metric tons to standard tons by multiplying:						
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)					
	Therefore, new activity level =			953173.57	tons/yr		
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS),							
Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as							
control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge							
Incinerators in the survey.							
Survey results for control devices							
		wt factor					
Uncontrolled		0.0238095					
Controlled	VS	0.1547619					
	CS	0.0119048					
	CS/VS/IS	0.1190476					
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level	
	VS/IS	0.3809524		controlled =	97.619048	% of activity level	
	VS/CS	0.047619					
	VS/IS/AB	0.2261905					
	VS/IS/ES	0.0119048					
Uncontrolled Activity Level =		22694.609	tons/yr				
Controlled Activity Level =		930478.96	tons/yr				
Emission = Emission Factor * Weight Factor*Activity Level							
		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	8.20E-04		18.61				
Controlled-VS					7.70E-03		
Controlled-CS							
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS	4.80E-04						
Controlled-VS/CS	1.40E-05						
Controlled-VS/IS/AB							
Controlled-VS/IS/ES							
Average weighted controlled	4.28E-04		398.45		7.70E-03		7164.69
(this includes the wt factor)							
	Total Emissions (lb/yr)		**417.06**		Total Emissions (lb/yr)		**7164.69**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	417.06	X	84.21	+	7164.69	X	15.79
Total Emissions (lb/yr)	1482.5116						
Total Emissions (tpy)	0.7412558						

Methodology:

Calculating national emissions of Acetaldehyde								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	100							
Fluidized Bed	0							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled								
Controlled-VS								
Controlled-CS								
Controlled-CS/VS/IS								
Controlled-IS								
Controlled-VS/IS	3.20E-04							
Controlled-VS/CS								
Controlled-VS/IS/AB								
Controlled-VS/IS/ES								
Average weighted controlled	3.20E-04		297.75				0.00	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**297.75**		Total Emissions (lb/yr)		**0.00**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	297.75	X	100.00	+	0.00	X	0	
Total Emissions (lb/yr)	297.75327							
Total Emissions (tpy)	0.1488766							

Methodology:

Calculating national emissions of Acrylonitrile							
Activity Level =		8.647E+05	metric tons/yr				
Adjusted Percentages							
Furnace Type	% in use						
Multiple Hearth	100						
Fluidized Bed	0						
	Convert metric tons to standard tons by multiplying:						
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)					
	Therefore, new activity level =			953173.57	tons/yr		
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS),							
Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as							
control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge							
Incinerators in the survey.							
Survey results for control devices							
		wt factor					
Uncontrolled		0.0238095					
Controlled	VS	0.1547619					
	CS	0.0119048					
	CS/VS/IS	0.1190476					
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level	
	VS/IS	0.3809524		controlled =	97.619048	% of activity level	
	VS/CS	0.047619					
	VS/IS/AB	0.2261905					
	VS/IS/ES	0.0119048					
Uncontrolled Activity Level =		22694.609	tons/yr				
Controlled Activity Level =		930478.96	tons/yr				
Emission = Emission Factor * Weight Factor*Activity Level							
		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	5.00E-02		1134.73				
Controlled-VS							
Controlled-CS							
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS	3.40E-02						
Controlled-VS/CS	3.00E-04						
Controlled-VS/IS/AB	9.80E-04						
Controlled-VS/IS/ES							
Average weighted controlled	2.01E-02		18741.88				0.00
(this includes the wt factor)							
	Total Emissions (lb/yr)		**19876.61**		Total Emissions (lb/yr)		**0.00**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	19876.61	X	100.00	+	0.00	X	0
Total Emissions (lb/yr)	19876.607						
Total Emissions (tpy)	9.9383034						

APPENDIX A: NATIONAL ESTIMATES - Sewage Sludge Incineration

Methodology:

Calculating national emissions of Arsenic								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	84.21							
Fluidized Bed	15.79							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled	9.40E-03		213.33		4.40E-03		99.86	
Controlled-VS	1.00E-04							
Controlled-CS								
Controlled-CS/VS/IS	1.70E-03							
Controlled-IS								
Controlled-VS/IS	1.20E-03				3.00E-05			
Controlled-VS/CS	2.00E-04							
Controlled-VS/IS/AB	8.00E-05							
Controlled-VS/IS/ES					1.00E-05			
Average weighted controlled	7.57E-04		704.06		2.94E-05		27.35	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**917.39**		Total Emissions (lb/yr)		**127.21**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	917.39	X	84.21	+	127.21	X	15.79	
Total Emissions (lb/yr)	792.62152							
Total Emissions (tpy)	0.3963108							

Methodology:

Calculating national emissions of Benzene								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	84.21							
Fluidized Bed	15.79							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled	1.20E-02		272.34					
Controlled-VS	2.80E-02							
Controlled-CS								
Controlled-CS/VS/IS								
Controlled-IS								
Controlled-VS/IS	1.30E-02				4.00E-04			
Controlled-VS/CS	7.00E-04							
Controlled-VS/IS/AB	3.40E-04							
Controlled-VS/IS/ES								
Average weighted controlled	1.16E-02		10799.85		4.00E-04		372.19	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**11072.19**		Total Emissions (lb/yr)		**372.19**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	11072.19	X	84.21	+	372.19	X	15.79	
Total Emissions (lb/yr)	9382.6566							
Total Emissions (tpy)	4.6913283							

Methodology:

Calculating national emissions of Beryllium								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	_% in use_							
Multiple Hearth	84.21							
Fluidized Bed	15.79							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =				953173.57	tons/yr		
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				_Fluidized Bed_		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled	3.00E-04		6.81					
Controlled-VS								
Controlled-CS	1.80E-05							
Controlled-CS/VS/IS								
Controlled-IS								
Controlled-VS/IS	1.00E-05				4.00E-07			
Controlled-VS/CS								
Controlled-VS/IS/AB								
Controlled-VS/IS/ES					4.00E-07			
Average weighted controlled	1.19E-05		11.05		4.00E-07		0.37	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**17.86**		Total Emissions (lb/yr)		**0.37**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	17.86	X	84.21	+	0.37	X	15.79	
Total Emissions (lb/yr)	15.099808							
Total Emissions (tpy)	0.0075499							

Methodology:

Calculating national emissions of bis(2-Ethylhexyl)phthalate								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	84.21							
Fluidized Bed	15.79							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled	1.90E-03		43.12					
Controlled-VS								
Controlled-CS								
Controlled-CS/VS/IS								
Controlled-IS								
Controlled-VS/IS	6.40E-04				8.20E-02			
Controlled-VS/CS	8.00E-05							
Controlled-VS/IS/AB								
Controlled-VS/IS/ES								
Average weighted controlled	5.78E-04		537.61		8.20E-02		76299.27	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**580.73**		Total Emissions (lb/yr)		**76299.27**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	580.73	X	84.21	+	76299.27	X	15.79	
Total Emissions (lb/yr)	12536.688							
Total Emissions (tpy)	6.268344							

Methodology:

Calculating national emissions of Cadmium							
Activity Level =		8.647E+05	metric tons/yr				
Adjusted Percentages							
Furnace Type	% in use						
Multiple Hearth	84.21						
Fluidized Bed	15.79						
	Convert metric tons to standard tons by multiplying:						
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)					
	Therefore, new activity level =			953173.57	tons/yr		

Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.

Survey results for control devices						
		wt factor				
Uncontrolled		0.0238095				
Controlled	VS	0.1547619				
	CS	0.0119048				
	CS/VS/IS	0.1190476				
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level
	VS/IS	0.3809524		controlled =	97.619048	% of activity level
	VS/CS	0.047619				
	VS/IS/AB	0.2261905				
	VS/IS/ES	0.0119048				
Uncontrolled Activity Level =		22694.609	tons/yr			
Controlled Activity Level =		930478.96	tons/yr			

Emission = Emission Factor * Weight Factor*Activity Level

		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	3.70E-02		839.70		4.40E-03		4094.11
Controlled-VS	2.20E-04						
Controlled-CS	3.40E-02						
Controlled-CS/VS/IS	1.60E-02						
Controlled-IS	2.40E-03				8.00E-04		
Controlled-VS/IS	6.60E-03				1.10E-03		
Controlled-VS/CS	2.60E-02						
Controlled-VS/IS/AB	6.00E-03						
Controlled-VS/IS/ES	2.00E-04				2.00E-06		
Average weighted controlled	7.70E-03		7160.83		1.05E-03		978.39
(this includes the wt factor)							
	Total Emissions (lb/yr)		**8000.53**		Total Emissions (lb/yr)		**5072.49**

	Multiple Hearth (lb/yr)		Wt. Percent		Fluidized Bed (lb/yr)		Wt. Percent
Emissions	8000.53	X	84.21	+	5072.49	X	15.79
Total Emissions (lb/yr)	7538.1933						
Total Emissions (tpy)	3.7690967						

Methodology:

Calculating national emissions of Carbon Tetrachloride							
Activity Level =		8.647E+05	metric tons/yr				
Adjusted Percentages							
Furnace Type	% in use						
Multiple Hearth	84.21						
Fluidized Bed	15.79						
	Convert metric tons to standard tons by multiplying:						
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)					
	Therefore, new activity level =			953173.57	tons/yr		

Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.

Survey results for control devices							
		wt factor					
Uncontrolled		0.0238095					
Controlled	VS	0.1547619					
	CS	0.0119048					
	CS/VS/IS	0.1190476					
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level	
	VS/IS	0.3809524		controlled =	97.619048	% of activity level	
	VS/CS	0.047619					
	VS/IS/AB	0.2261905					
	VS/IS/ES	0.0119048					
Uncontrolled Activity Level =		22694.609	tons/yr				
Controlled Activity Level =		930478.96	tons/yr				
Emission = Emission Factor * Weight Factor*Activity Level							
		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	2.00E-05		0.45				
Controlled-VS							
Controlled-CS							
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS	6.00E-05				2.40E-05		
Controlled-VS/CS	1.40E-05						
Controlled-VS/IS/AB	2.00E-06						
Controlled-VS/IS/ES							
Average weighted controlled	3.66E-05		34.07		2.40E-05		22.33
(this includes the wt factor)							
	Total Emissions (lb/yr)		**34.53**		Total Emissions (lb/yr)		**22.33**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	34.53	X	84.21	+	22.33	X	15.79
Total Emissions (lb/yr)	32.600774						
Total Emissions (tpy)	0.0163004						

Methodology:

Calculating national emissions of Chloroform

Activity Level =		8.647E+05	metric tons/yr			
Adjusted Percentages						
Furnace Type	% in use					
Multiple Hearth	84.21					
Fluidized Bed	15.79					
	Convert metric tons to standard tons by multiplying:					
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)				
	Therefore, new activity level =			953173.57	tons/yr	

Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.

Survey results for control devices						
		wt factor				
Uncontrolled		0.0238095				
Controlled	VS	0.1547619				
	CS	0.0119048				
	CS/VS/IS	0.1190476				
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level
	VS/IS	0.3809524		controlled =	97.619048	% of activity level
	VS/CS	0.047619				
	VS/IS/AB	0.2261905				
	VS/IS/ES	0.0119048				
Uncontrolled Activity Level =		22694.609	tons/yr			
Controlled Activity Level =		930478.96	tons/yr			

Emission = Emission Factor * Weight Factor*Activity Level

		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	6.00E-05		1.36				
Controlled-VS	6.60E-03						
Controlled-CS							
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS	2.60E-03				4.00E-03		
Controlled-VS/CS	4.00E-05						
Controlled-VS/IS/AB	9.80E-04						
Controlled-VS/IS/ES							
Average weighted controlled	2.76E-03		2569.49		4.00E-03		3721.92
(this includes the wt factor)							
	Total Emissions (lb/yr)		**2570.85**		Total Emissions (lb/yr)		**3721.92**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	2570.85	X	84.21	+	3721.92	X	15.79
Total Emissions (lb/yr)	2752.605						
Total Emissions (tpy)	1.3763025						

APPENDIX A: NATIONAL ESTIMATES - Sewage Sludge Incineration

Methodology:

Calculating national emissions of Chromium							
Activity Level =		8.647E+05	metric tons/yr				
Adjusted Percentages							
Furnace Type	% in use						
Multiple Hearth	84.21						
Fluidized Bed	15.79						
	Convert metric tons to standard tons by multiplying:						
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)					
	Therefore, new activity level =			953173.57	tons/yr		

Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.

Survey results for control devices							
		wt factor					
Uncontrolled		0.0238095					
Controlled	VS	0.1547619					
	CS	0.0119048					
	CS/VS/IS	0.1190476					
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level	
	VS/IS	0.3809524		controlled =	97.619048	% of activity level	
	VS/CS	0.047619					
	VS/IS/AB	0.2261905					
	VS/IS/ES	0.0119048					
Uncontrolled Activity Level =		22694.609	tons/yr				
Controlled Activity Level =		930478.96	tons/yr				

Emission = Emission Factor * Weight Factor*Activity Level							
		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	2.90E-02						
Controlled-VS	1.00E-03						
Controlled-CS	3.80E-03						
Controlled-CS/VS/IS	2.70E-02						
Controlled-IS	1.90E-02				6.40E-04		
Controlled-VS/IS	4.20E-03				5.00E-04		
Controlled-VS/CS	1.00E-03						
Controlled-VS/IS/AB	9.80E-03						
Controlled-VS/IS/ES	2.20E-04				6.00E-05		
Average weighted controlled	7.92E-03		7371.44		4.95E-04		460.99
(this includes the wt factor)							
	Total Emissions (lb/yr)		**7371.44**		Total Emissions (lb/yr)		**460.99**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	7371.44	X	84.21	+	460.99	X	15.79
Total Emissions (lb/yr)	6280.2758						
Total Emissions (tpy)	3.1401379						

Methodology:

Calculating national emissions of Ethylene Dichloride								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	100							
Fluidized Bed	0							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled								
Controlled-VS								
Controlled-CS								
Controlled-CS/VS/IS								
Controlled-IS								
Controlled-VS/IS	2.00E-05							
Controlled-VS/CS	8.00E-06							
Controlled-VS/IS/AB	6.00E-05							
Controlled-VS/IS/ES								
Average weighted controlled	3.29E-05		30.66				0.00	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**30.66**		Total Emissions (lb/yr)		**0.00**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	30.66	X	100.00	+	0.00	X	0	
Total Emissions (lb/yr)	30.655052							
Total Emissions (tpy)	0.0153275							

APPENDIX A: NATIONAL ESTIMATES - Sewage Sludge Incineration

Methodology:

Calculating national emissions of Formaldehyde								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	100							
Fluidized Bed	0							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS),								
Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as								
control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge								
Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled								
Controlled-VS	8.00E-04							
Controlled-CS								
Controlled-CS/VS/IS								
Controlled-IS								
Controlled-VS/IS								
Controlled-VS/CS	2.60E-03							
Controlled-VS/IS/AB								
Controlled-VS/IS/ES								
Average weighted controlled	1.22E-03		1138.47					
(this includes the wt factor)								
	Total Emissions (lb/yr)		**1138.47**		Total Emissions (lb/yr)		**0.00**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	1138.47	X	100.00	+	0.00	X	0	
Total Emissions (lb/yr)	1138.4684							
Total Emissions (tpy)	0.5692342							

APPENDIX A: NATIONAL ESTIMATES - Sewage Sludge Incineration

Methodology:

Calculating national emissions of Lead								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	84.21							
Fluidized Bed	15.79							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS),								
Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as								
control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge								
Incinerators in the survey.								
Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled	1.00E-01		2269.46		4.00E-02		907.78	
Controlled-VS	1.80E-03							
Controlled-CS	6.00E-02							
Controlled-CS/VS/IS	2.20E-02							
Controlled-IS	4.00E-02				6.00E-03			
Controlled-VS/IS	6.00E-02				1.60E-01			
Controlled-VS/CS	6.00E-03							
Controlled-VS/IS/AB	1.00E-01							
Controlled-VS/IS/ES					2.00E-06			
Average weighted controlled	5.22E-02		48561.81		1.47E-01		136434.85	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**50831.27**		Total Emissions (lb/yr)		**137342.64**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	50831.27	X	84.21	+	137342.64	X	15.79	
Total Emissions (lb/yr)	64491.417							
Total Emissions (tpy)	32.245709							

Methodology:

Calculating national emissions of Manganese

Activity Level =		8.647E+05	metric tons/yr		
Adjusted Percentages					
Furnace Type	% in use				
Multiple Hearth	84.21				
Fluidized Bed	15.79				
	Convert metric tons to standard tons by multiplying:				
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)			
	Therefore, new activity level =			953173.57	tons/yr

Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.

Survey results for control devices

		wt factor				
Uncontrolled		0.0238095				
Controlled	VS	0.1547619				
	CS	0.0119048				
	CS/VS/IS	0.1190476				
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level
	VS/IS	0.3809524		controlled =	97.619048	% of activity level
	VS/CS	0.047619				
	VS/IS/AB	0.2261905				
	VS/IS/ES	0.0119048				
Uncontrolled Activity Level =		22694.609	tons/yr			
Controlled Activity Level =		930478.96	tons/yr			

Emission = Emission Factor * Weight Factor*Activity Level

		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	1.90E-02		431.20				
Controlled-VS							
Controlled-CS	6.60E-04						
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS	1.70E-03				6.00E-04		
Controlled-VS/CS							
Controlled-VS/IS/AB							
Controlled-VS/IS/ES							
Average weighted controlled	1.67E-03		1552.49		6.00E-04		558.29
(this includes the wt factor)							
	Total Emissions (lb/yr)		**1983.69**		Total Emissions (lb/yr)		**558.29**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	1983.69	X	84.21	+	558.29	X	15.79
Total Emissions (lb/yr)	1758.6169						
Total Emissions (tpy)	0.8793085						

APPENDIX A: NATIONAL ESTIMATES - Sewage Sludge Incineration

Methodology:

Calculating national emissions of Methylene Chloride

Activity Level =		8.647E+05	metric tons/yr

Adjusted Percentages

Furnace Type	% in use
Multiple Hearth	84.21
Fluidized Bed	15.79

Convert metric tons to standard tons by multiplying:

(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)

Therefore, new activity level = 953173.57 tons/yr

Survey results indicate that Sew age Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The w eighting percentages were established. Control Devices w ere on 82 of the 84 Sew age Sludge Incinerators in the survey.

Survey results for control devices

		w t factor				
Uncontrolled		0.0238095				
Controlled	VS	0.1547619				
	CS	0.0119048				
	CS/VS/IS	0.1190476				
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level
	VS/IS	0.3809524		controlled =	97.619048	% of activity level
	VS/CS	0.047619				
	VS/IS/AB	0.2261905				
	VS/IS/ES	0.0119048				
Uncontrolled Activity Level =		22694.609	tons/yr			
Controlled Activity Level =		930478.96	tons/yr			

Emission = Emission Factor * Weight Factor*Activity Level

		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	8.00E-04		18.16				
Controlled-VS							
Controlled-CS							
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS	1.80E-03				1.40E-03		
Controlled-VS/CS	6.00E-04						
Controlled-VS/IS/AB	8.00E-04						
Controlled-VS/IS/ES							
Average w eighted controlled	1.37E-03		1272.22		1.40E-03		1302.67
(this includes the w t factor)							
	Total Emissions (lb/yr)		**1290.37**		Total Emissions (lb/yr)		**1302.67**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	1290.37	X	84.21	+	1302.67	X	15.79

Total Emissions (lb/yr)	1292.3158
Total Emissions (tpy)	0.6461579

APPENDIX A: NATIONAL ESTIMATES - Sewage Sludge Incineration

Methodology:

Calculating national emissions of Nickel								
Activity Level =		8.647E+05	metric tons/yr					
Adjusted Percentages								
Furnace Type	% in use							
Multiple Hearth	84.21							
Fluidized Bed	15.79							
	Convert metric tons to standard tons by multiplying:							
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)						
	Therefore, new activity level =			953173.57	tons/yr			

Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.

Survey results for control devices								
		wt factor						
Uncontrolled		0.0238095						
Controlled	VS	0.1547619						
	CS	0.0119048						
	CS/VS/IS	0.1190476						
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level		
	VS/IS	0.3809524		controlled =	97.619048	% of activity level		
	VS/CS	0.047619						
	VS/IS/AB	0.2261905						
	VS/IS/ES	0.0119048						
Uncontrolled Activity Level =		22694.609	tons/yr					
Controlled Activity Level =		930478.96	tons/yr					
Emission = Emission Factor * Weight Factor*Activity Level								
		Multiple Hearth				Fluidized Bed		
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)	
Uncontrolled	1.60E-02		363.11		3.50E-02		794.31	
Controlled-VS	1.20E-04							
Controlled-CS	1.60E-04							
Controlled-CS/VS/IS	9.00E-03							
Controlled-IS	8.20E-03							
Controlled-VS/IS	1.80E-03				3.40E-03			
Controlled-VS/CS	7.00E-04							
Controlled-VS/IS/AB	1.80E-03							
Controlled-VS/IS/ES					1.00E-05			
Average weighted controlled	2.50E-03		2328.72		3.30E-03		3068.04	
(this includes the wt factor)								
	Total Emissions (lb/yr)		**2691.84**		Total Emissions (lb/yr)		**3862.35**	
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent	
	(lb/yr)				(lb/yr)			
Emissions	2691.84	X	84.21	+	3862.35	X	15.79	
Total Emissions (lb/yr)	2876.6628							
Total Emissions (tpy)	1.4383314							

APPENDIX A: NATIONAL ESTIMATES - Sewage Sludge Incineration

Methodology:

Calculating national emissions of Tetrachloroethylene							
Activity Level =		8.647E+05	metric tons/yr				
Adjusted Percentages							
Furnace Type	% in use						
Multiple Hearth	84.21						
Fluidized Bed	15.79						
	Convert metric tons to standard tons by multiplying:						
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)					
	Therefore, new activity level =			953173.57	tons/yr		
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.							
Survey results for control devices							
		wt factor					
Uncontrolled		0.0238095					
Controlled	VS	0.1547619					
	CS	0.0119048					
	CS/VS/IS	0.1190476					
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level	
	VS/IS	0.3809524		controlled =	97.619048	% of activity level	
	VS/CS	0.047619					
	VS/IS/AB	0.2261905					
	VS/IS/ES	0.0119048					
Uncontrolled Activity Level =		22694.609	tons/yr				
Controlled Activity Level =		930478.96	tons/yr				
Emission = Emission Factor * Weight Factor*Activity Level							
		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	8.00E-04		18.16				
Controlled-VS	4.00E-04						
Controlled-CS							
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS					2.40E-04		
Controlled-VS/CS	6.00E-04						
Controlled-VS/IS/AB							
Controlled-VS/IS/ES							
Average weighted controlled	4.47E-04		415.98		2.40E-04		223.31
(this includes the wt factor)							
	Total Emissions (lb/yr)		**434.13**		Total Emissions (lb/yr)		**223.31**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	434.13	X	84.21	+	223.31	X	15.79
Total Emissions (lb/yr)	400.84611						
Total Emissions (tpy)	0.2004231						

Methodology:

Calculating national emissions of Trichloroethylene							
Activity Level =		8.647E+05	metric tons/yr				
Adjusted Percentages							
Furnace Type	% in use						
Multiple Hearth	84.21						
Fluidized Bed	15.79						
	Convert metric tons to standard tons by multiplying:						
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)					
	Therefore, new activity level =			953173.57	tons/yr		

Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.

Survey results for control devices							
		wt factor					
Uncontrolled		0.0238095					
Controlled	VS	0.1547619					
	CS	0.0119048					
	CS/VS/IS	0.1190476					
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level	
	VS/IS	0.3809524		controlled =	97.619048	% of activity level	
	VS/CS	0.047619					
	VS/IS/AB	0.2261905					
	VS/IS/ES	0.0119048					
Uncontrolled Activity Level =		22694.609	tons/yr				
Controlled Activity Level =		930478.96	tons/yr				
Emission = Emission Factor * Weight Factor*Activity Level							
		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	8.00E-04		18.16				
Controlled-VS							
Controlled-CS							
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS	9.00E-04				6.00E-05		
Controlled-VS/CS							
Controlled-VS/IS/AB							
Controlled-VS/IS/ES							
Average weighted controlled	9.00E-04		837.43		6.00E-05		55.83
(this includes the wt factor)							
	Total Emissions (lb/yr)		**855.59**		Total Emissions (lb/yr)		**55.83**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	855.59	X	84.21	+	55.83	X	15.79
Total Emissions (lb/yr)	729.30496						
Total Emissions (tpy)	0.3646525						

Methodology:

Calculating national emissions of Vinyl Chloride							
Activity Level =		8.647E+05	metric tons/yr				
Adjusted Percentages							
Furnace Type	% in use						
Multiple Hearth	100						
Fluidized Bed	0						
	Convert metric tons to standard tons by multiplying:						
		(activity level)*(2204.6 lb/metric ton)*(1 ton/2000lb)					
	Therefore, new activity level =			953173.57	tons/yr		
Survey results indicate that Sewage Sludge Incinerators typically use Venturi Scrubbers (VS), Cyclone Scrubbers (CS), Impingement Tray Scrubbers (IS), Afterburners (AB), Electrostatic Precipitators (ES), and/or a combination of these, as control devices. The weighting percentages were established. Control Devices were on 82 of the 84 Sewage Sludge Incinerators in the survey.							
Survey results for control devices							
		wt factor					
Uncontrolled		0.0238095					
Controlled	VS	0.1547619					
	CS	0.0119048					
	CS/VS/IS	0.1190476					
	IS	0.0238095	Therefore, uncontrolled =		2.3809524	% of activity level	
	VS/IS	0.3809524		controlled =	97.619048	% of activity level	
	VS/CS	0.047619					
	VS/IS/AB	0.2261905					
	VS/IS/ES	0.0119048					
Uncontrolled Activity Level =		22694.609	tons/yr				
Controlled Activity Level =		930478.96	tons/yr				
Emission = Emission Factor * Weight Factor*Activity Level							
		Multiple Hearth				Fluidized Bed	
	Emission Factor (lb/ton)		Emission (lb/yr)		Emission Factor (lb/ton)		Emission (lb/yr)
Uncontrolled	1.30E-02		295.03				
Controlled-VS							
Controlled-CS							
Controlled-CS/VS/IS							
Controlled-IS							
Controlled-VS/IS	7.40E-03						
Controlled-VS/CS	2.00E-03						
Controlled-VS/IS/AB							
Controlled-VS/IS/ES							
Average weighted controlled	6.80E-03		6327.26				0.00
(this includes the wt factor)							
	Total Emissions (lb/yr)		**6622.29**		Total Emissions (lb/yr)		**0.00**
	Multiple Hearth		Wt. Percent		Fluidized Bed		Wt. Percent
	(lb/yr)				(lb/yr)		
Emissions	6622.29	X	100.00	+	0.00	X	0
Total Emissions (lb/yr)	6622.2869						
Total Emissions (tpy)	3.3111434						

APPENDIX A: NATIONAL ESTIMATES - Shipbuilding and Ship Repair (Surface Coating)

Methodology:

1990 base year estimates for the Shipbuilding and Ship Repair (Surface Coating) source category were developed from based on data provided by U.S. EPA/ESD and from the Toxic Release Inventory (TRI). EPA provided 1990 use of certain solvents that are HAPs in various coating industries.[1,2] These HAPs were Toluene, Xylene, Glycol Ethers, Methyl Ethyl Ketone, and Methyl Isobutyl Ketone. It is assumed that all solvent used in coatings and added during coating application are emitted as the coating dries. For this effort, data for the Marine: Commercial and Maintenance" market segments were assumed to apply to the Shipbuilding and Ship Repair (Surface Coating) MACT source category.

The remaining HAP estimates were taken from TRI.[3] A list of 29 major Ship Building and Ship Repair facilities from an EPA guidebook was used to extract data from TRI.[4] All report to SIC Code 3731--Ship building and repairing. Any styrene and methyl methacrylate estimates associated with these facilities were considered to be part of the Boat Manufacturing NESHAP and were not used for the Ship Building and Ship Repair MACT source category.[5] Furthermore, any additional facilities reporting under SIC Code 3731 that were not on EPA's list of 29 were assigned to the Boat Manufacturing NESHAP.

The following is a list of HAPs estimated from the TRI database:

Acrylonitrile	Lead
Chlorine	Manganese
Chromium	Methyl Chloroform
Diethanolamine	Methylene Chloride
Ethylbenzene	Nickel
Ethylene Dichloride	Polycyclic Organic Matter as 16-PAH
Ethylene Glycol	Trichloroethylene

References:

1. Salman, D. U.S. Environmental Protection Agency, Emission Standards Division. Personal communication with E. Paik, Eastern Research Group, Inc. Confirming emissions and control status for surface coating MACT standards. December 17 & 18, 1997.

2. Salman, D. U.S. Environmental Protection Agency, Emission Standards Division. Note to B. Driscoll, U.S. EPA. "HAP information for coatings industries." June 20, 1997.

3. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

4. U.S. Environmental Protection Agency. A Guidebook on How to Comply with Shipbuilding and Ship Repair (Surface Coating) Operations National Emission Standards for Hazardous Air Pollutants. EPA 453/B-97-001. January 1997.

5. Telephone conversation between Dr. Mohamed Serageldin, EPA, and Regi Oommen, ERG. July 22, 1998.

Methodology:

Emissions from Softwood Drying Kilns

The estimates of acetaldehyde and formaldehyde emissions in 1990 from softwood drying kilns are provided by the National Council of the Paper Industry for Air and Stream Improvement, Inc. At the time the estimates were provided, it was acknowledged that due to large uncertainties in the emission factors that were still under review, total nationwide estimates could differ from the preliminary estimates provided.

Steam Heated Kiln emissions + Direct Fired Kiln emissions = Softwood Drying Kiln emissions.

<u>Acetaldehyde</u>
27 tons + 15 tons = 42 tons acetaldehyde / year

<u>Formaldehyde</u>
54 tons + 23 tons = 77 tons formaldehyde / year

Double counting of emissions of formaldehyde occurs between the NCASI estimate and the estimate for the Plywood Manufacturing MACT (15 tons). Subtracting the MACT estimate from the NCASI estimate for the Sawmills and Planing Mills, General category will result in the contribution of formaldehyde from Softwood Drying Kilns.

77 tons formaldehyde (NCASI estimate) - 15 tons formaldehyde (TRI estimate of portion covered under MACT = 62 tons / year.

References:

1) National Council of the Paper Industry for Air and Stream Improvement, Inc. to L. McKelvey, U.S. Environmental Protection Agency. Comments regarding the Draft Integrated Urban Air Toxics Strategy. November 19, 1998.

Methodology:

Emission estimates for Spandex Production are from 1990 TRI data (Reference 1). These data were extracted from TRI based on a facility list provided by U.S. EPA/ESD (Reference 2). There were 3 facilities operating in the U.S. in 1990 that produced spandex. Two of these facilities (Globe Manufacturing facility in Massachusetts and North Carolina) only produced spandex whereas one facility (DuPont facility in Waynesboro, Virginia) is a multipurpose facility that produced several other products in addition to spandex, in 1990. It is not possible to quantify the Hazardous Air Pollutants (HAPs) listed in the TRI data for the DuPont facility that are attributed only to spandex production because this integrated facility produced so many other products in 1990. Therefore, the emission estimates (tons/year) for Spandex Production are based only on the two Globe Manufacturing facilities, as presented below.

Facility Name	Location	Toluene Emissions	Methylene Chloride Emissions	Toluene-2,4-Diisocyanate Emissions
Globe Mfg. Co.	Falls River, MA	171.300	0.000	0.000
Globe Mfg. Co.	Gastonia, NC	93.950	12.700	0.128
	TOTAL:	**265.250 TPY**	**12.700 TPY**	**0.128 TPY**

References:

1. U.S. Environmental Protection Agency. *Toxics Release Inventory 1987-1995 CD ROM (1990 Data).* EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

2. Kissell, M.T. U.S. Environmental Protection Agency, Emission Standards Division. Emission estimates and facility locations for Spandex Fiber Production. Provided to E. Paik, Eastern Research Group, Inc. July 24, 1997.

Methodology:

The activity level of 1,530 trillion BTU per year for natural gas fired turbines was provided by the Emissions Standards Division {Porter, 1998}. The number was obtained by extrapolation assuming that the growth rate in activity level for turbines from 1978 to 1985 was the same as the growth rate from 1985 to 1978. A compound growth rate was assumed. All turbines were assumed to be fired with natural gas.

The emission factors for acetaldehyde, benzene, formaldehyde, and POM as 16 PAH were provided by the Emissions Standards Division {Porter, 1998}.

References:

Porter, Fred, U.S. Environmental Protection Agency, Emissions Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Stationary Turbine information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

Methodology:

Calculating National Estimates for Acetaldehyde, Benzene, Formaldehyde, and POM as 16 PAH

Activity Level =	1.53E+09	MM Btu/yr natural gas		

All turbines are assumed to be natural-gas-fired. Activity was extrapolated from 1985 based on growth from 1978 to 1985. A compound growth rate was assumed.

Turbines used for electricity generation		Turbines used for pipelines	
Year	Quadrillion Joules	Year	Quadrillion Joules
1978	488	1978	449
1985	781	1985	488
1990	1093	1990	518

1990 activity level = 781 x (e^(ln(781/488)/7))^5 = 1093

1990 activity level = 488 x (e^(ln(488/449)/7))^5 = 518

Total turbine activity = electricity + pipeline = 1093 + 518 = 1611 Quadrillion Joules

conversion to MM Btu = quadrillion joules x 0.000948 Btu/joule x 1,000,000,000 MM Btu/quadrillion joules

= 1611 x 0.000948 x 1,000,000,000 = 1,530,000,000 MM Btu

Nationwide Emissions from Natural-Gas-Fired Turbines, 1990

Pollutant	Emission Factor (lb/MM Btu)	Emission Factor Reference	National Activity Level (Reference 1) (MM Btu natural gas burned/year)	National Emissions (tons/year)
Acetaldehyde	9.1E-05	Reference 1	1.53E+09	6.96E+01
Benzene	1.0E-05	Reference 1	1.53E+09	7.65E+00
Formaldehyde	7.1E-04	Reference 1	1.53E+09	5.43E+02
POM as 16 PAH	1.5E-06	Reference 1	1.53E+09	1.15E+00

Example Calculation:

National Emissions (tons/year) = Emission Factor (lb/MM Btu) x National Activity Level (MM Btu/year)/2000 lb/ton

National Acetaldehyde Emissions (tons/year) = 0.000091 lb/MM Btu x 1,530,000,000 MM Btu/yr/2000 lb/ton = 69.6 tons/year

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Stationary Turbine information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

Methodology:

The activity level of 100 trillion Btu per year for diesel oil-fired stationary internal combustion engines was provided by the Emissions Standards Division {Porter, 1998}. The number was obtained by extrapolation assuming that the growth rate in activity level for turbines from 1978 to 1985 was the same as the growth rate from 1985 to 1990. A compound growth rate was assumed for pipeline engines and the ratio of gas to oil engines was assumed to be the same in 1990 as 1978.

The emission factors for acetaldehyde, benzene, formaldehyde, POM as 16-PAH, arsenic, beryllium, cadmium, chromium, lead, manganese, and mercury were provided by the Emissions Standards Division {Porter, 1998}.

The emission factors for POM as 7 PAH and POM as EOM were obtained from the 112(c)(6) report {US EPA, 1997}. Naphthalene was the only PAH detected.

References:

Porter, Fred, U.S. Environmental Protection Agency, Emissions Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Stationary Internal Combustion Engine information in the “Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report,” September 18, 1998. November 13, 1998.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Calculating National Estimates for Acetaldehyde, Benzene, Formaldehyde, POM as 7-PAH, POM as EOM, POM as 16-PAH, Arsenic, Beryllium, Cadmium, Chromium, Lead, Manganese, and Mercury

Activity Level = 1.00E+08 MM Btu/yr diesel oil

Activity was extrapolated for pipeline engines from 1985 based on growth from 1978 to 1985. A compound growth rate was assumed. Distribution between gas and oil fired engines was assumed to be the same in 1990 as in 1978.

	Engines used for electricity generation (Quadrillion joules)		Engines used for pipelines (Quadrillion joules)	
Year	Natural Gas	Diesel Oil	Natural Gas	Diesel Oil
1978	25	31	1004	62
1985	15	43	1093	73
1990	26	34	1171	72

1990 activity level for electricity is assumed. pipeline 1990 activity level = 1166 x (e^(ln(1166/1066)/7))^5 = 1243

oil pipeline 1990 activity level = 1243 x 62/1066 = 72

Total oil engine activity = oil elect. + oil pipeline = 34 + 72 = 106 Quadrillion Joules

conversion to MM Btu = quadrillion joules x 0.000948 Btu/joule x 1,000,000,000 MM Btu/quadrillion joules

= 106 x 0.000948 x 1,000,000,000 = 100,000,000 MM Btu

Nationwide Emissions from Diesel-Oil-Fired Stationary Internal Combustion Engines, 1990

Pollutant	Emission Factor (lb/MM Btu)	Emission Factor Reference	National Activity Level (Reference 1) (MM Btu diesel oil burned/year)	National Emissions (tons/year)
Acetaldehyde	2.5E-04	Reference 1	1.00E+08	1.25E+01
Arsenic	4E-06	Reference 1	1.00E+08	2.00E-01
Benzene	8.6E-04	Reference 1	1.00E+08	4.30E+01
Beryllium	3E-06	Reference 1	1.00E+08	1.50E-01
Cadmium	3E-06	Reference 1	1.00E+08	1.50E-01
Chromium	3E-06	Reference 1	1.00E+08	1.50E-01
Formaldehyde	1.0E-04	Reference 1	1.00E+08	5.00E+00
Lead	9.E-06	Reference 1	1.00E+08	4.50E-01
Manganese	6.E-06	Reference 1	1.00E+08	3.00E-01
Mercury	3.E-06	Reference 1	1.00E+08	1.50E-01
POM as 7 PAH	3.36.E-06	Reference 2	1.00E+08	1.68E-01
POM as EOM	7.9.E-02	Reference 2	1.00E+08	3.95E+03
POM as 16 PAH	4.0E-04	Reference 1	1.00E+08	2.00E+01

Example Calculation:

National Emissions (tons/year) = Emission Factor (lb/MM Btu) x National Activity Level (MM Btu/year)/2000 lb/ton

National Acetaldehyde Emissions (tons/year) = 0.00025 lb/MM Btu x 100,000,000 MM Btu/yr/2000 lb/ton = 12.5 tons/year

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Stationary Internal Combustion Engine information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

The activity level of 1,130 trillion Btu per year for natural gas-fired stationary internal combustion engines was provided by the Emissions Standards Division {Porter, 1998}. The number was obtained by extrapolation assuming that the growth rate in activity level for turbines from 1978 to 1985 was the same as the growth rate from 1985 to 1990. A compound growth rate was assumed for pipeline engines and the ratio of gas to oil engines was assumed to be the same in 1990 as 1978.

The emission factors for acetaldehyde, benzene, formaldehyde, and POM as 16-PAH were provided by the Emissions Standards Division {Porter, 1998}. Naphthalene was the only PAH detected.

The emission factor for POM as 7 PAH was obtained from the 112(c)(6) report {US EPA, 1997}.

References:

Porter, Fred, U.S. Environmental Protection Agency, Emissions Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Stationary Internal Combustion Engine information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Calculating National Estimates for Acetaldehyde, Benzene, Formaldehyde, POM as 7-PAH, and POM as 16-PAH

Activity Level = 1.13E+09 MM Btu/yr natural gas

Activity was extrapolated for pipeline engines from 1985 based on growth from 1978 to 1985. A compound growth rate was assumed. Distribution between gas and oil fired engines was assumed to be the same in 1990 as in 1978.

	Engines used for electricity generation (Quadrillion joules)		Engines used for pipelines (Quadrillion joules)	
Year	Gas	Oil	Gas	Oil
1978	25	31	1004	62
1985	15	43	1093	73
1990	26	34	1171	72

1990 activity level for electricity is assumed.

pipeline 1990 activity level = 1166 x (e^(ln(1166/1066)/7))^5 = 1243

gas pipeline 1990 activity level = 1243 x1004/1066 = 1171

Total gas engine activity = gas electricity + gas pipeline = 26 + 1 1197 Quadrillion Joules

conversion to MM Btu = quadrillion joules x 0.000948 Btu/joule x 1,000,000,000 MM Btu/quadrillion joules

= 1197 x 0.000948 x 1,000,000,000 = 1,130,000,000 MM Btu

Nationwide Emissions from Natural-Gas-Fired Stationary Internal Combustion Engines, 1990

Pollutant	Emission Factor (lb/MM Btu)	Emission Factor Reference	National Activity Level (Reference 1) (MM Btu natural gas burned/year)	National Emissions (tons/year)
Acetaldehyde	4.2E-03	Reference 1	1.13E+09	2.37E+03
Benzene	1.7E-03	Reference 1	1.13E+09	9.61E+02
Formaldehyde	5.0E-02	Reference 1	1.13E+09	2.83E+04
POM as 7 PAH	2.2E-06	Reference 2	1.13E+09	1.24E+00
POM as 16 PAH	1.0E-04	Reference 1	1.13E+09	5.65E+01

Example Calculation:

National Emissions (tons/year) = Emission Factor (lb/MM Btu) x National Activity Level (MM Btu/year)/2000 lb/ton

Acetaldehyde Emissions (tons/year) = 0.0042 lb/MM Btu x 1,130,000,000 MM Btu/yr/2000 lb/ton = 2,370 tons/year

References:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Stationary Internal Combustion Engine information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Acrolein

The 1992 activity levels for acrolein and formaldehyde come from the 112(k) report (U.S. EPA, 1996). A similar number of structure fires was assumed to have occurred in 1990. The emission factors for acrolein and formaldehyde come from the Air Toxics Emission Inventories for the Chicago Area (U.S. EPA, 1995).

References

U.S. Environmental Protection Agency. National Urban Area Source Emissions of Benzene, 1,3-Butadiene, Formadehyde, Trichloroethylene, Perchloroethylene, Methylene Chloride, and Carbon Tetrachloride. Final Report. Research Triangle Park, North Carolina. March 1996.

U.S. Environmental Protection Agency. Air Toxics Emissions Inventories for the Chicago Area. Draft report. Washington D.C. July 1995.

Methodology:

ACROLEIN								
Activity data:		7.50E+11	dry standard cubic feet (dscf)					
Contol device:		Not applicable						
Emission factor:		2.55E-05	lb poll/dscf					
Estimate:								
	(2.55e-5 lb/dscf)(7.5e+11dscf/yr)/2000lb poll/ton poll=					9562.5	tons poll/yr	
						19125000	lbs poll/yr	

Methodology:

Taconite Iron Ore Processing

AP-42 provides 1989 activity data for the 10 large processing plants that produce 99 percent of taconite iron ore. Kilns are a source of lead and VOC HAP emissions resulting from iron ore processing. Other taconite iron ore processes such as crushing and grinding emits particulate matter that is likely to contain metal HAPs (U.S. EPA, 1997). Since data were not available to speciate particulate emissions and to determine the type of processes employed at each facility, HAP emissions due to particulates are not estimated in this effort.

AP-42 states that natural gas-fired kilns are the most common kiln type used and that most large plants and new plants use a grate/kiln. The combination of multicyclones and wet scrubbers is a common control configuration for SO_2 and PM in furnace waste gas. The estimate for lead uses an emission factor available from AP-42 for a gas-fired grate/kiln with a multicyclone. The AP-42 VOC emission factor for an uncontrolled gas-fired grate/kiln is used to estimate VOC emissions since control technologies do not address VOCs. The VOC emission factor has an "E" quality rating while the lead factor has a "D" quality rating (U.S. EPA, 1997). VOC emissions are speciated using a SPECIATE profile. For gas-fired taconite iron ore processing kilns, SPECIATE provides a VOC profile for an uncontrolled gas-fired external combustion boiler with a data quality rating of "B" (U.S. EPA, 1995).

The following HAPs are emitted from this source category:

Benzene
Formaldehyde
Lead
Toluene

__References__
1. U.S. Environmental Protection Agency. Emission Factor Documentation for AP-42 Section 11.23: Taconite Ore Processing, Final Report. Research Triangle Park, North Carolina. February 1997.

2. U.S. Environmental Protection Agency. TOC/PM Speciation Data System, Version 2.03. Research Triangle Park, North Carolina. May 1995.

Methodology:

Taconite Iron Ore Processing

Activity (ref. 1)

Total 1989 usable ore (fired pellets) produced =	59,000	metric tons

Emission Factor (ref. 1)

VOC*	3.70E-03	lb/ton
Lead**	5.00E-04	lb/ton

Emissions

Emissions
=(metric tons produced/year) * (lb emitted/ton produced) * (ton/2000 lb) * (1.1 ton/metric ton)

VOC	1.20E-01	tons/year
LEAD	**1.62E-02**	tons/year

Speciated VOC HAP Emissions = VOC Emission * % Total VOC/100%

SPECIATE VOC Profile (ref. 2)	% of Total VOC	VOC HAP Emissions	
ISOMERS OF HEXANE	1	***	
ISOMERS OF PENTANE	9	***	
METHANE	56	***	
PROPANE	4	***	
N-BUTANE	9	***	
N-PENTANE	6	***	
CYCLOHEXANE	1	***	
FORMALDEHYDE	8	**9.61E-03**	tons/year
BENZENE	4	**4.80E-03**	tons/year
TOLUENE	2	**2.40E-03**	tons/year
Total	**100**		

*Emission factors for gas-fired grate/kilns, uncontrolled
**Emission factors for gas-fired grate/kilns with multiclone
*** Not a HAP

Methodology:

Emissions associated with the manufacture of tires are based on a model plant developed by INDUS for the EPA's MACT development effort. The model plant was assumed to have a production rate of 40,000 tire/day for 360 days/year or 14,400,000 tires/year.

Emission factors for each of the processes composing tire production were taken from a study performed by the Rubber Manufacturers Association.[1] Emissions from the cementing and building processes could not be included because speciated data were not available. The study lists emission factors for several types of rubber compound recipes. At EPA's direction, only data for Compound Recipes #1 through #7 were summed for mixing, milling, extrusion, and calendering. The mean of different tires was used for tire curing. For grinding, an average was calculated for sidewall, carcass, and belt grinding. These emissions factors were applied to the pounds of rubber processed in each process of the model plant to estimate emissions from the model plant for each of the pollutants.

Although emission factors were provided for o-Cresol separately from emission factors for m- and p-Cresols combined, for this effort the emission factors were all combined into one emission factor for Cresols (mixed isomers).

To obtain aggregated per tire emission factors, the model plant process emissions were summed for each pollutant and divided by the model plant annual tire production (14,400,000 tires/yr).[3] These aggregated per tire emission factors were multiplied by the actual 1990 tire production (264,262,000 tires) to estimate annual emissions for that base year.[2]

A list of facilities was taken from an INDUS report[4] and FIP state and county codes were assigned to each facility. Tony Wayne, EPA/OAQPS, approximated the capacity of the facilities on the list and national emissions were proportioned to these facilities relative to these approximate capacities.

References:

1. Letter from Dale A. Louda, Manager of Regulatory Affairs, Rubber Manufacturers Association to Ron Ryan, EPA/OAQPS, June 6, 1995.

2. Rubber Manufacturers Association, Monthly Tire Report, December 1990.

3. Letter from Wally Sanford, INDUS Corporation, to Tony Wayne, EPA/OAQPS, Rubber Tire Manufacture NESHAP: Revised Emission Estimates, March 14, 1997.

4. Letter from Wally Sanford, INDUS Corporation, to Tony Wayne, EPA/OAQPS, Rubber Tire Manufacture NESHAP, September 30, 1996.

APPENDIX A: NATIONAL ESTIMATES - Tire Production

Methodology:

MODEL PLANT PARAMETERS

Process	Rubber Processed (lbs/yr)	EF Type
Mixing	3.24E+08	a
Milling	6.48E+08	b
Extrusion	1.94E+08	c
Calendering	1.30E+08	d
Cementing	3.24E+08	Currently no speciated data for this process
Building	3.24E+08	Currently no speciated data for this process
Curing	3.24E+08	e
Grinding	3.24E+06	f

EMISSION FACTORS (lb/lb rubber)

Pollutants	a	b	c	d	e	f
1,1,1-Trichloroethane	2.0E-06	1.7E-07	1.8E-07	5.3E-08	2.0E-07	
1,1,2,2-Tetrachloroethane	2.1E-06					
1,1,2-Trichloroethane	2.1E-06				2.1E-07	
1,1-Dichloroethane	2.1E-06				2.1E-07	
1,1-Dichloroethene	2.5E-06				2.1E-07	
1,2,4-Trichlorobenzene	5.6E-08	2.4E-08	3.5E-08	2.6E-09	9.0E-09	
1,2-Dibromo-3-chloropropane	4.2E-06	4.7E-08	4.4E-07	1.6E-07	4.3E-07	
1,2-Dibromoethane	2.1E-06				2.1E-07	
1,2-Dichloroethane	2.1E-06			1.2E-07	2.1E-07	
1,2-Dichloropropane	2.1E-06				2.1E-07	
1,3-Butadiene	9.1E-07	4.0E-08	6.0E-07	1.1E-08	4.3E-07	2.5E-05
1,4-Dichlorobenzene	2.1E-06	2.1E-08	1.8E-08	5.5E-08	4.3E-08	2.0E-06
1,4-Dioxane	8.4E-06				8.5E-07	
1,4-Phenylenediamine	1.3E-07					
2,2,4-Trimethylpentane		9.6E-08				4.2E-05
2,4,5-Trichlorophenol	8.0E-08	3.1E-08	5.3E-08	3.4E-09		
2,4,6-Trichlorophenol	8.1E-08	3.2E-08	5.1E-08	3.6E-09		
2,4-Dinitrophenol	2.8E-07	1.1E-07	1.8E-07	1.1E-08		
2,4-Dinitrotoluene	7.7E-08	2.8E-08	4.5E-08	3.2E-09		
2-Butanone	1.5E-05	1.3E-06	2.5E-07	2.6E-07	7.8E-07	2.0E-05
2-Butene	1.2E-06					
2-Chloroacetophenone			1.6E-08			
3,3'-Dichlorobenzidine	1.7E-07					
3,3'-Dimethoxybenzidine	2.1E-07	1.8E-08	8.5E-08	6.0E-09		
3,3'-Dimethylbenzidine	7.2E-08	7.4E-09	3.2E-08	2.2E-09		
4,4'-Methylenedianiline	1.3E-07	1.5E-08	6.4E-08	3.8E-09		
4,6-Dinitro-2-methylphenol	1.9E-07					
4-Aminobiphenyl	3.1E-08	8.4E-09	2.2E-08	1.9E-09		
4-Methyl-2-Pentanone	5.9E-05	1.0E-05	8.1E-06	6.4E-07	1.3E-05	
4-Nitrobiphenyl	6.6E-08	1.6E-08	4.5E-08	3.2E-09		
4-Nitrophenol	2.1E-07	7.3E-08	1.4E-07	5.1E-09		
a,a,a-Trichlorotoluene	4.2E-08					
Acetaldehyde	7.0E-07					1.0E-05
Acetonitrile	4.2E-06	5.7E-07	5.6E-07	1.6E-07	4.3E-07	
Acetophenone	3.4E-07	3.1E-07	3.1E-06	4.9E-09	1.1E-07	3.4E-06
Acrolein	4.2E-06	5.7E-07	6.4E-07	1.3E-07	4.2E-07	2.4E-05
Acrylonitrile	4.2E-06	4.0E-07	4.4E-07	1.6E-07	4.3E-07	
Allyl Chloride	4.2E-06	5.7E-07	4.4E-07	1.6E-07	4.3E-07	
Aniline	1.1E-06	8.8E-06	6.5E-07	9.4E-08	2.5E-06	1.4E-04
Benzene	7.8E-07	1.3E-07	3.1E-07	4.5E-08	3.6E-07	6.1E-06
Benzidine	8.7E-08	1.1E-08	3.7E-08	2.0E-09		
Benzyl Chloride	4.2E-06	1.6E-08	4.2E-07	1.6E-07	7.0E-08	
Biphenyl	8.5E-08	1.1E-07	1.9E-08	1.8E-08	5.3E-08	1.1E-06

Methodology:

MODEL PLANT PARAMETERS

EMISSION FACTORS (lb/lb rubber) - continued

Pollutants	a	b	c	d	e	f
bis(2-Chloroethyl)ether	7.3E-08					
Bis(2-ethylhexyl)phthalate	4.2E-07	1.0E-06	1.9E-07	7.3E-07	2.6E-07	2.6E-05
Bromoform	1.9E-06	2.9E-07	2.2E-07	7.8E-08	2.1E-07	
Bromomethane	2.1E-06				1.8E-07	
Cadmium	3.2E-08					8.3E-07
Carbon Disulfide	5.5E-06	9.4E-07	3.8E-07	2.4E-06	7.7E-06	1.1E-04
Carbon Tetrachloride	2.0E-06	2.9E-07	2.2E-07	7.8E-08	2.1E-07	
Carbonyl Sulfide	3.2E-06	1.0E-06	3.8E-07	9.6E-08	4.4E-07	
Chlorobenzene	2.1E-06	2.9E-07	2.2E-07	7.8E-08	2.1E-07	
Chloroethane	2.1E-06				2.1E-07	
Chloroform	2.1E-06	2.9E-07	2.2E-07	7.8E-08	2.0E-07	
Chloromethane	1.8E-06		1.4E-07	2.2E-08	1.3E-07	
Chromium	2.8E-07		2.7E-07			1.1E-05
Cresols	5.2E-07	8.5E-08	3.1E-08	3.7E-09	2.6E-08	
Cumene	2.5E-07	1.9E-08	1.2E-07	6.3E-08	3.7E-07	
Dimethyl phthalate	3.4E-08	7.7E-08	1.5E-08		4.6E-08	
Dimethylaminoazobenzene	1.0E-07					
Di-n-butyl phthalate	1.7E-07	3.1E-07	2.8E-07		3.3E-07	2.4E-06
Epichlorohydrin	4.2E-06	5.7E-07	4.2E-07	1.6E-07	4.3E-07	
Ethylbenzene	5.2E-06	2.0E-07	1.1E-07	1.6E-07	8.7E-06	1.9E-05
Hexachlorobenzene	6.9E-08	2.5E-08	4.4E-08	2.8E-09		
Hexachlorobutadiene	4.2E-06	3.7E-08	5.3E-08	1.6E-07	4.3E-07	
Hexachlorocyclopentadiene	9.3E-08	4.8E-08	5.8E-08	5.8E-09		
Hexachloroethane	1.0E-07	4.5E-08	5.4E-08	3.5E-09		
Hydroquinone	2.7E-05	3.4E-08	5.0E-08	4.0E-08		
Isophorone	7.5E-07	1.2E-05	3.2E-08	1.3E-07	2.9E-08	1.2E-06
Lead	5.3E-08					1.2E-05
Methyl tert-Butyl ether	3.6E-06				4.3E-07	
Methylene Chloride	4.7E-05	2.1E-06	1.5E-05	8.0E-08	3.0E-06	1.4E-03
Methylenebischloroaniline	2.6E-07					
n,n-Dimethylaniline	3.8E-08		3.2E-09			
Naphthalene	7.3E-07	6.2E-07	2.4E-07	1.2E-07	1.7E-07	2.8E-06
n-Hexane	3.1E-05	1.1E-06	5.0E-07	5.6E-07	3.0E-06	6.1E-05
Nickel	3.3E-07		2.7E-07			1.2E-05
Nitrobenzene	6.0E-08	2.4E-08	2.9E-08	2.3E-09		
n-Nitrosodimethylamine	7.2E-08	5.0E-08	1.1E-07	7.4E-09		
n-Nitrosomorpholine	9.3E-08	4.4E-08	4.8E-08	6.5E-09		
o-Anisidine	7.3E-08	3.1E-08	4.4E-08	5.8E-09		
o-Toluidine	2.6E-07	2.2E-08	1.4E-07	3.2E-09	8.4E-08	
Pentachloronitrobenzene	1.7E-07	7.2E-08	1.3E-07	2.0E-08		
Pentachlorophenol	1.4E-07	4.0E-08	5.3E-08	3.5E-09		
Phenol	1.2E-06	6.5E-08	2.6E-07	1.5E-07	3.3E-07	8.8E-06
Propylene Oxide	4.2E-06	5.7E-07	2.1E-06	1.6E-07	6.4E-07	
Styrene	4.4E-06	1.7E-07	7.4E-07	4.9E-07	5.3E-07	
Tetrachloroethene	5.5E-06	2.2E-07	2.0E-07	7.8E-08	1.6E-07	1.7E-04
Toluene	9.7E-06	8.9E-07	9.4E-06	3.9E-06	1.1E-05	3.7E-03
Trichloroethene	2.1E-06				2.0E-07	
Trifluralin	1.2E-07	4.6E-08	6.8E-08	1.0E-08		
Vinyl Acetate	4.2E-06	2.9E-07	2.2E-07	7.8E-08	2.1E-07	
Vinyl Chloride	2.1E-06	2.9E-07	2.2E-07	7.8E-08	2.1E-07	
Xylenes	2.8E-05	1.4E-06	7.1E-07	5.7E-07	2.9E-05	2.3E-05

Methodology:

MODEL PLANT ESTIMATE (lbs of Pollutant) (a)								EMISSION ESTIMATE		
Pollutants	Mixing	Milling	Extru-sion	Calend-ering	Curing	Grinding	TOTAL	Aggr. EF (b) lb/tire	lb/yr (C)	tons/yr
1,1,1-Trichloroethane	654	110	35	7	64	0	870	6.1E-05	15,995	7.998
1,1,2,2-Tetrachloroethane	677	0	0	0	0	0	677	4.7E-05	12,430	6.215
1,1,2-Trichloroethane	677	0	0	0	69	0	746	5.2E-05	13,696	6.848
1,1-Dichloroethane	677	0	0	0	69	0	746	5.2E-05	13,699	6.85
1,1-Dichloroethene	823	0	0	0	69	0	892	6.2E-05	16,357	8.179
1,2,4-Trichlorobenzene	18	15	7	0	3	0	43	3.0E-06	798	0.399
1,2-Dibromo-3-chloropropane	1354	30	85	20	138	0	1628	1.1E-04	29,874	14.937
1,2-Dibromoethane	677	0	0	0	69	0	746	5.2E-05	13,693	6.847
1,2-Dichloroethane	677	0	0	16	69	0	762	5.3E-05	13,987	6.993
1,2-Dichloropropane	677	0	0	0	69	0	746	5.2E-05	13,696	6.848
1,3-Butadiene	296	26	116	1	138	81	658	4.6E-05	12,071	6.035
1,4-Dichlorobenzene	677	13	3	7	14	6	721	5.0E-05	13,241	6.62
1,4-Dioxane	2709	0	0	0	276	0	2985	2.1E-04	54,774	27.387
1,4-Phenylenediamine	42	0	0	0	0	0	42	2.9E-06	779	0.39
2,2,4-Trimethylpentane	0	62	0	0	0	137	199	1.4E-05	3,657	1.828
2,4,5-Trichlorophenol	26	20	10	0	0	0	57	4.0E-06	1,046	0.523
2,4,6-Trichlorophenol	26	20	10	0	0	0	57	4.0E-06	1,048	0.524
2,4-Dinitrophenol	92	71	35	1	0	0	199	1.4E-05	3,652	1.826
2,4-Dinitrotoluene	25	18	9	0	0	0	52	3.6E-06	953	0.477
2-Butanone	4698	836	49	34	254	63	5934	4.1E-04	109,007	54.504
2-Butene	386	0	0	0	0	0	386	2.7E-05	7,076	3.538
2-Chloroacetophenone	0	0	3	0	0	0	3	2.2E-07	57	0.028
3,3'-Dichlorobenzidine	56	0	0	0	0	0	56	3.9E-06	1,020	0.51
3,3'-Dimethoxybenzidine	67	12	17	1	0	0	96	6.6E-06	1,754	0.877
3,3'-Dimethylbenzidine	23	5	6	0	0	0	34	2.4E-06	633	0.316
4,4'-Methylenedianiline	43	10	13	0	0	0	66	4.6E-06	1,215	0.607
4,6-Dinitro-2-methylphenol	60	0	0	0	0	0	60	4.2E-06	1,106	0.553
4-Aminobiphenyl	10	5	4	0	0	0	20	1.4E-06	364	0.182
4-Methyl-2-Pentanone	19,246	6739	1575	83	4244	0	31,887	2.2E-03	585,616	292.808
4-Nitrobiphenyl	21	10	9	0	0	0	41	2.8E-06	746	0.373
4-Nitrophenol	69	47	27	1	0	0	144	1.0E-05	2,647	1.324
a,a,a-Trichlorotoluene	14	0	0	0	0	0	14	9.5E-07	250	0.125
Acetaldehyde	225	0	0	0	0	33	258	1.8E-05	4,739	2.369
Acetonitrile	1354	369	108	20	138	0	1990	1.4E-04	36,505	18.253
Acetophenone	109	203	595	1	36	11	954	6.6E-05	17,523	8.762
Acrolein	1354	369	125	17	135	76	2076	1.4E-04	38,092	19.046
Acrylonitrile	1354	261	85	20	138	0	1859	1.3E-04	34,107	17.053
Allyl Chloride	1354	369	85	20	138	0	1966	1.4E-04	36,081	18.04
Aniline	340	5696	127	12	810	460	7445	5.2E-04	136,554	68.277
Benzene	252	85	61	6	115	20	539	3.7E-05	9,899	4.95
Benzidine	28	7	7	0	0	0	43	3.0E-06	783	0.392
Benzyl Chloride	1354	10	82	20	23	0	1489	1.0E-04	27,326	13.663
Biphenyl	28	74	4	2	17	4	128	8.9E-06	2,349	1.174
bis(2-Chloroethyl)ether	24	0	0	0	0	0	24	1.6E-06	435	0.218
Bis(2-ethylhexyl)phthalate	137	648	38	95	85	86	1089	7.6E-05	20,030	10.015
Bromoform	616	185	43	10	69	0	922	6.4E-05	16,943	8.472
Bromomethane	677	0	0	0	60	0	737	5.1E-05	13,527	6.763
Cadmium	10	0	0	0	0	3	13	9.2E-07	242	0.121
Carbon Disulfide	1795	607	73	312	2495	360	5641	3.9E-04	103,520	51.76
Carbon Tetrachloride	632	185	43	10	69	0	938	6.5E-05	17,232	8.616
Carbonyl Sulfide	1034	654	74	12	142	0	1916	1.3E-04	35,127	17.563
Chlorobenzene	677	185	43	10	69	0	984	6.8E-05	18,049	9.025
Chloroethane	677	0	0	0	69	0	746	5.2E-05	13,696	6.848
Chloroform	677	185	43	10	64	0	979	6.8E-05	17,969	8.984

Methodology:

MODEL PLANT ESTIMATE (lbs of Pollutant) (a) - continued								EMISSION ESTIMATE		
Pollutants	Mixing	Milling	Extru-sion	Calend-ering	Curing	Grinding	TOTAL	Aggr. EF (b) lb/tire	lb/yr (C)	tons/yr
Chloromethane	580	0	27	3	41	0	650	4.5E-05	11,903	5.952
Chromium	89	0	52	0	0	35	176	1.2E-05	3,236	1.618
Cresols	170	55	6	0	8	0	240	1.7E-05	4,403	2.202
Cumene	82	12	23	8	119	0	243	1.7E-05	4,468	2.234
Dimethyl phthalate	11	50	3	0	15	0	78	5.4E-06	1,437	0.718
Dimethylaminoazobenzene	34	0	0	0	0	0	34	2.3E-06	616	0.308
Di-n-butyl phthalate	54	200	54	0	106	8	422	2.9E-05	7,749	3.875
Epichlorohydrin	1354	369	82	20	138	0	1963	1.4E-04	36,020	18.01
Ethylbenzene	1678	130	22	20	2806	63	4719	3.3E-04	86,607	43.303
Hexachlorobenzene	22	16	8	0	0	0	47	3.3E-06	869	0.435
Hexachlorobutadiene	1351	24	10	20	138	0	1544	1.1E-04	28,335	14.167
Hexachlorocyclopentadiene	30	31	11	1	0	0	73	5.1E-06	1,339	0.67
Hexachloroethane	33	29	10	0	0	0	73	5.1E-06	1,340	0.67
Hydroquinone	8780	22	10	5	0	0	8817	6.1E-04	161,696	80.848
Isophorone	243	7452	6	17	9	4	7732	5.4E-04	142,036	71.018
Lead	17	0	0	0	0	37	54	3.8E-06	998	0.499
Methyl tert-Butyl ether	1163	0	0	0	138	0	1301	9.0E-05	23,849	11.924
Methylene Chloride	15,098	1361	2877	10	969	4601	24,916	1.7E-03	457,316	228.658
Methylenebischloroaniline	84	0	0	0	0	0	84	5.8E-06	1,534	0.767
n,n-Dimethylaniline	12	0	1	0	0	0	13	9.0E-07	238	0.119
Naphthalene	237	400	47	16	54	9	762	5.3E-05	13,991	6.995
n-Hexane	9947	706	96	72	978	196	11,997	8.3E-04	219,863	109.931
Nickel	107	0	53	0	0	37	197	1.4E-05	3,611	1.805
Nitrobenzene	19	15	6	0	0	0	41	2.8E-06	749	0.374
n-Nitrosodimethylamine	23	33	20	1	0	0	77	5.4E-06	1,418	0.709
n-Nitrosomorpholine	30	28	9	1	0	0	69	4.8E-06	1,260	0.63
o-Anisidine	24	20	9	1	0	0	53	3.7E-06	968	0.484
o-Toluidine	84	14	26	0	27	0	151	1.1E-05	2,781	1.39
Pentachloronitrobenzene	53	47	26	3	0	0	129	8.9E-06	2,364	1.182
Pentachlorophenol	46	26	10	0	0	0	83	5.8E-06	1,525	0.763
Phenol	402	42	51	19	107	28	649	4.5E-05	11,930	5.965
Propylene Oxide	1354	369	406	20	208	0	2358	1.6E-04	43,258	21.629
Styrene	1429	113	143	63	172	0	1919	1.3E-04	35,211	17.605
Tetrachloroethene	1785	143	39	10	52	544	2574	1.8E-04	47,207	23.604
Toluene	3156	579	1823	508	3629	12,020	21,716	1.5E-03	398,527	199.264
Trichloroethene	677	0	0	0	65	0	743	5.2E-05	13,631	6.815
Trifluralin	38	30	13	1	0	0	82	5.7E-06	1,502	0.751
Vinyl Acetate	1374	185	43	10	69	0	1680	1.2E-04	30,809	15.405
Vinyl Chloride	677	185	43	10	69	0	984	6.8E-05	18,052	9.026
Xylenes	8910	907	138	74	9461	73	19,563	1.4E-03	359,122	179.561

*National Estimate is based on the total tires produced in 1990 = 2.6E+08

Methodology:

Sample Calculations:

(a) Model Plant Estimate, lbs of pollutants per year, from each type of process
= (Pollutant EF for a process) x (rubber processed in that process)

Example: lbs/yr 1,1,2-Trichloroethane from Mixing = (1,1,2-Trichloroethane Mixing EF) x (Rubber Processed in Mixing)
= (2.09E-06 lb 1,1,2-Trichloroethane / lb rubber) x (3.24E+08 lbs rubber processed in mixing per year)
= 677 lbs/yr

(b) Aggregate Emission Factor, lbs/tire (I.e., the overall EF for the model plant)
= Model Plant Total Estimate / Model Plant Production Rate

Example: Aggregate 1,1,2-Trichloroethane EF = (Model Plant Total Estimate for 1,1,2-Trichloroethane) / (14,400,000 tires/yr)
= (746 lbs/yr 1,1,2-Trichloroethane) / (14,400,000 tires/yr)
= 5.18E-05 lbs/tire

(C) National Emission Estimate, tons/yr, = (Aggregate EF) x (Total tires produced in 1990)

Example: National 1,1,2-Trichloroethane emission estimate = (Aggregate 1,1,2-Trichloroethane EF) x (264,262,000 tires)
= (5.18E-05 lbs 1,1,2-Trichloroethane/tire) x (264,262,000 tires)
= 13,696 lbs/yr
= 6.848 tons/yr

Methodology:

Emission estimates and the number of facilities reported for coal-fired utility boilers were taken directly from the following reference:

U.S. Environmental Protection Agency. Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units--Interim Final Report. EPA-453/R-96-013b.

Emissions in the above document were based on emissions test data from 52 units obtained from extensive emission tests by the Electric Power Research Institute, the Department of Energy, the Northern States Power Company, and the EPA. The testing program was designed to test a wide range of facility types with a variety of control scenarios.

Based on recommendations by the Emission Standards Division {Porter, 1998}, 1990 emissions were estimated for the following pollutants from the information in the Utility Report cited above:

Acetaldehyde
Acetophenone
Acrolein
Antimony
Arsenic
Benzene
Beryllium
bis(2-ethylhexyl)phthalate
Cadmium
Carbon Disulfide
Chlorobenzene
Chromium
Cobalt
Dioxin/Furans
Ethylbenzene
Ethylene Dichloride
Formaldehyde
Hexane
Hydrochloric Acid
Hydrogen Fluoride
Isophorone
Lead
Manganese
Mercury
Methyl Bromide
Methyl Chloride
Methyl Ethyl Ketone
Methylene Chloride
Nickel
Phenol
Polycyclic Organic Matter as 7-PAH
Polycyclic Organic Matter as 16-PAH
Propionaldehyde
Selenium
Styrene
Tetrachloroethylene
Toluene

The polycyclic organic matter as EOM estimate is from the 112(c)(6) report.

<u>References:</u>

Porter, Fred, U.S. Environmental Protection Agency, Emissions Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Utility Boilers information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources–Interim Final Report," September 18, 1998. November 13, 1998.

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Methodology:

Utility Boilers - Coal Combustion (all types)					SCAT673		
Calculation of 7-PAH and 16-PAH emissions							
All individual PAH emissions come directly from EPA electric utility report (see above)							
		7-PAH	16-PAH				
PAH	tons/yr	tons/yr	tons/yr				
benz(a)anthracene	0.018						
benzo(a)pyrene	0.0088						
benzo(b)fluoranthene	0.07						
benzo(k)fluoranthene	0.031						
chrysene	0.022						
dibenz(a,h)anthracene	0.003						
indeno(1,2,3-cd)pyrene	0.054	0.2068					
acenaphthene	0.07						
acenaphthylene	0.036						
anthracene	0.036						
benzo(ghi)perylene	0.038						
fluoranthene	0.064						
fluorene	0.11						
naphthalene	6.6						
phenanthrene	0.31						
pyrene	0.081		7.5518				

Methodology:

HAP emissions on the following page for utility boilers burning petroleum coke were calculated using emission factors. The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for acetaldehyde, benzene, ethylene dichloride, methyl chloride, styrene, acrolein, bis(2-ethylhexyl) phthalate, formaldehyde, methylene chloride, and tetrachloroethylene. These emission factors are from 10 facilities firing bituminous, 8 facilities firing subbituminous, and 1 facility firing lignite. Factors apply to boilers utilizing both wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator or fabric filter:

The Emission Standards Division {Porter, 1998} supplied emission factors based on AP-42 {US EPA, 1996} for arsenic, cadmium, lead, mercury, beryllium, chromium, manganese, and nickel. These emission factors are from 11 facilities firing bituminous, 15 facilities firing subbituminous, and 2 facilities firing lignite. Factors apply to boilers utilizing either venturi scrubbers, spray dryer absorbers, or wet limestone scrubbers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers utilizing only an electrostatic precipitator, fabric filter, or venturi scrubber.

The Emission Standards Division {Porter, 1998} supplied emission factors for dioxins/furans (as toxic equivalency units) and POM as 16 PAH. The emission factor for POM as 7 PAH was calculated using the emission factors for benz[a]anthracene, benzo[b,j,k]fluoranthene, benzo[a]pyrene, chrysene, and indeno[1,2,3-c,d]pyrene provided in AP-42 {US EPA, 1996}. These emission factors are from six sites firing bituminuous coal, four sites firing subbituminous coal, and one site firing lignite. Factors apply to boilers using either wet limestone scrubbers or spray dryers with an electrostatic precipitator or fabric filter. In addition, the factors apply to boilers using only an electrostatic precipitator or fabric filter. The emission factor for POM as EOM of 1.35 pound per short ton of coal was obtained from the 112(c)(6) report {US EPA, 1997}.

1990 national activity level for energy input to electric utilities for petroleum coke was obtained directly from the EIA {EIA, 1992}. The conversion factor used to convert activity from btu to tons was obtained from AP-42 {EPA, 1996}.

<u>References</u>:

1. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Utility Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.

2. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.

3. Energy Information Administration. State Energy Data Report, Consumption Estimates 1960-1990. DOE/EIA-0214(90). U.S. Department of Energy, Washington, D.C. May 1992.

4. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

APPENDIX A: NATIONAL ESTIMATES - Utility Boilers - Coke

Methodology:

Nationwide Emissions from Utility Boilers for Coke Combustion, 1990

Pollutant	Emission Factor (lb/ton coke)	Emission Factor Reference	National Activity Level (Reference 1, 2) (tons coke burned/year)	National Emissions (tons/year)
acetaldehyde	5.7E-04	Reference 2, 3	9.29E+05	2.65E-01
acrolein	2.9E-04	Reference 2, 3	9.29E+05	1.35E-01
arsenic	4.1E-04	Reference 2, 3	9.29E+05	1.90E-01
benzene	1.3E-03	Reference 2, 3	9.29E+05	6.04E-01
beryllium	2.1E-05	Reference 2, 3	9.29E+05	9.75E-03
bis(2-ethylhexyl)phthalate	7.3E-05	Reference 2, 3	9.29E+05	3.39E-02
cadmium	5.1E-05	Reference 2, 3	9.29E+05	2.37E-02
chromium	2.6E-04	Reference 2, 3	9.29E+05	1.21E-01
dioxins/furans (TEQ units)	3.5E-12	Reference 3	9.29E+05	1.63E-09
ethylene dichloride	4.0E-05	Reference 2, 3	9.29E+05	1.86E-02
formaldehyde	2.4E-04	Reference 2, 3	9.29E+05	1.11E-01
lead	4.2E-04	Reference 2, 3	9.29E+05	1.95E-01
manganese	4.9E-04	Reference 2, 3	9.29E+05	2.28E-01
mercury	8.3E-05	Reference 2, 3	9.29E+05	3.85E-02
methyl chloride	5.3E-04	Reference 2, 3	9.29E+05	2.46E-01
methylene chloride	2.9E-04	Reference 2, 3	9.29E+05	1.35E-01
nickel	2.8E-04	Reference 2, 3	9.29E+05	1.30E-01
POM as 16-PAH	1.9E-05	Reference 3	9.29E+05	8.82E-03
POM as 7-PAH	3.9E-07	Reference 3	9.29E+05	1.81E-04
POM as EOM	1.35E+00	Reference 2, 3	9.29E+05	6.27E+02
styrene	2.5E-05	Reference 2, 3	9.29E+05	1.16E-02
tetrachloroethylene	4.3E-05	Reference 2, 3	9.29E+05	2.00E-02

References:

1. Energy Information Administration, State Energy Data Report, Consumption Estimates 1960-1990. DOE/EIA-0214(90). U.S. Department of Energy, Washington, D.C. May 1992.
2. U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors, 5th Edition, AP-42, Volume I: Stationary Point and Area Sources. Research Triangle Park, North Carolina. 1996.
3. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Utility Boiler information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources -- Interim Final Report," September 18, 1998. November 13, 1998.
4. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)6 Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD)/2,3,7,8-Tetrachlorodibenzo-furan (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

Conversion of Activity level in Btu for coke into tons of coke:

Activity level, btu =	24.7	trillion Btu/yr	utility coke use	
	Heating value, coke =		13300	btu/lb
		trillion btu =	1.00E+12	btu
		ton =	2000	lb
Activity level, coke, tons =		9.29E+05	tons/yr	

Methodology:

Emission estimates and the number of facilities reported for natural gas-fired utility boilers were taken directly from the following reference:

> U.S. Environmental Protection Agency. Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units--Interim Final Report. EPA-453/R-96-013b.

Emissions in the above document were based on emissions test data from 52 units obtained from extensive emission tests by the Electric Power Research Institute, the Department of Energy, the Northern States Power Company, and the EPA. The testing program was designed to test a wide range of facility types with a variety of control scenarios.

Based on recommendations by the Emission Standards Division {Porter, 1998}, 1990 emissions were estimated for the following pollutants from the information in the Utility Report cited above:

Benzene	Polycyclic Organic Matter as 16-PAH
Formaldehyde	

Emissions for Acetaldehyde were estimated using the emission factor of 1.3 E-08 lb/MM Btu provided by the Emissions Standards Division {Porter, 1998} and an activity of 2.45 E09 MM Btu estimated from emissions data and emission factors provided in the Utility Report cited above.

<u>References:</u>

Porter, Fred, U.S. Environmental Protection Agency, Emissions Standards Division. Note to Anne Pope, U.S. EPA/Emissions Monitoring and Analysis Division. Comments on Utility Boilers information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources–Interim Final Report," September 18, 1998. November 13, 1998.

Methodology:

Calculation of Activity for Natural Gas Fired Utility Boilers:

Activity was estimated using the data in Table A-6 of the Utility Report.

Data from Table A-6 of the Utility Report (Reference 1)

Pollutant	Median Emission Factor (lb/trillion Btu)	1990 Emissions (total tons)	1990 Activity (trillion Btu/year)
Benzene	1.40E+00	1.80E+00	2.57E+03
Formaldehyde	3.55E+01	5.50E+01	3.10E+03
Naphthalene	7.00E-01	6.60E-01	1.89E+03
Toluene	1.00E+01	1.30E+01	2.60E+03
2-Methylnaphthalene	2.60E-02	2.50E-02	1.92E+03
Fluoranthene	2.80E-03	3.40E-03	2.43E+03
Fluorene	2.60E-03	3.40E-03	2.62E+03
1-Phenanthrene	1.30E-02	1.60E-02	2.46E+03
Pyrene	4.90E-03	6.10E-03	2.49E+03
		Average =	2.45E+03

1990 Activity (trillion Btu/year) = (1990 Emissions (tons/year) x 2000 lb/ton)/Emission Factor (lb/trillion Btu)

Conversion of activity in trillion Btu to MM Btu:

MM Btu = trillion Btu x 1,000,000 MM Btu/trillion Btu

= 2.45E+09 MM Btu

Calculation of Acetaldehyde Emissions:

Emission Factor for Acetaldehyde = 1.30E-08 lb/MM Btu

(provided by the Emissions Standard Division in Reference 2)

Acetaldehyde Emissions (tons/year) = Emission Factor (lb/MM Btu) X Activity (MM Btu/year)/2,000 lbs/ton

= 1.59E-02 tons/year

References:

1. U.S. Environmental Protection Agency. Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units--Interim Final Report. EPA-453/R-96-013b.

2. Porter, Fred, U.S. Environmental Protection Agency, Emission Standards Division. Note to Anne Pope, U.S. EPA/Emissions, Monitoring and Analysis Division. Comments on Utility Boilers information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources - Interim Final Report," September 18, 1998. November 13, 1998.

Methodology:

7-PAH emissions for utility combustion sources burning oil (residual and distillate) were taken directly from the following reference:

U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

The following reference was used for the estimate of number of facilities:

U.S. Environmental Protection Agency. Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units -- Interim Final Report. Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. EPA-453/R-96-013a. October 1996.

Methodology:

The activity data for 16-PAH were obtained from a memorandum from the American Wood Preservers Institute.[1] The emission factors were obtained from the POM L&E.[2] The estimate is based on emissions from two treatment types only and does not include fugitive emission sources. The estimate for dioxins/furans as 2,3,7,8-TCDD TEQ comes from the Section 112(c)(6) report[3] and does not assume any controls on emissions.

The remaining HAP estimates for Wood Preserving were taken from the TRI database based on the following SIC Code: 2491 (Wood Preserving).[4]

References

1. Memorandum from G.S. Bartlow, American Wood Preservers Institute, to Docket No. A-97-05, ERG. Notice of draft source category listing for section 112(c)(6) rulemaking pursuant to 112(c)(6) requirements. July 21, 1997.

2. U.S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Polycyclic Organic Matter. Final Report. Research Triangle Park, North Carolina. September 1996.

3. U.S. Environmental Protection Agency. 1990 Inventory of Section 112(c)(6) Pollutants: Polycyclic Organic Matter (POM), 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD)/ 2,3,7,8-Tetrachlorodibenzofuran (TCDF), Polychlorinated Biphenyl Compounds (PCBs), Hexachlorobenzene, Mercury, and Alkylated Lead. Final Report. Research Triangle Park, North Carolina. June 1997.

4. U.S. Environmental Protection Agency. Toxics Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Methodology:

16-PAH				
Activity:	9.32E+07	cubic feet of creosote treated w ood / yr		
Emission factor development:				
	Pollutant	Process	Control	Emission factor (lb poll/cubic foot w ood)
	Acenapthylene	creosote w ood treatment	vapor condenser	6.13E-04
	Fluorene	creosote w ood treatment	vapor condenser	1.67E-04
	Naphthalene	creosote w ood treatment	vapor condenser	2.20E-03
	Phenanthrene	creosote w ood treatment	vapor condenser	1.14E-04
			Sum	3.09E-03
	Acenaphthene	diluent w ood treatment	vapor condenser	8.08E-05
	Fluorene	diluent w ood treatment	vapor condenser	3.72E-05
	Naphthalene	diluent w ood treatment	vapor condenser	6.28E-04
	Phenanthrene	diluent w ood treatment	vapor condenser	4.11E-05
			Sum	7.87E-04
			Average of 2 process sums:	1.94E-03
Estimate:				

(9.32e7 cubic feet of creosote treated w ood/yr) (1.94e-3 lb poll/cubic foot of w ood) = 180859.26 lb poll/yr

90.42963 ton poll/yr

Methodology:

The following pollutant estimates for Wool Fiberglass Manufacturing were provided by EPA[1,2]:

Arsenic
Chromium
Formaldehyde
Lead
Methanol
Phenol

References

1. Telephone conversation between Bill Neuffer, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards and Bridget Kosmicki, Eastern Research Group. Subject: Emissions from wool fiberglass manufacturing. July, 1997.

2. Bill Neuffer, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Note to Mike Laney. Comments concerning methanol, phenol and formaldehyde in the Wool Fiberglass Manufacturing information in the "Baseline Emission Inventory of HAP Emissions from MACT Sources–Interim Final Report," September 18, 1998. October 13, 1998.

Appendix B

1990 Toxic Release Inventory Data Extracted Based On A Facility List

Appendix B presents source categories for which facility lists were used to extract TRI data.[2] These lists were primarily provided by EPA. For some source categories, the facility list defines the source category; for others, the facilities in the list represent only part of the source category. Source categories with estimates partially based on a facility list are described in Appendix A and can be identified by reviewing Table 8-1.

The data in this appendix are organized first alphabetically by source category and then by the Section 112(k) pollutant. The facility name and the TRI facility identification code are also listed. Note that facilities will only appear in this appendix if they reported one or more of the Section 112(k) HAPs. Furthermore, this appendix only includes estimates for Section 112(k) HAPs, not for any other TRI chemicals that were reported.

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[2] U.S. Environmental Protection Agency. Toxic Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

Index to Appendix B

112(k) Source Category

Pollutant	Facility Name	TRI ID
Commercial Sterilization Facilities		
Ethylene Oxide	ABBOTT CRITICAL CARE SYS.	84123BBTTC4455A
Ethylene Oxide	ABBOTT LABORATORIES	28352BBTTLHWY40
Ethylene Oxide	ABBOTT LABS.	27802BBTTLPOBOX
Ethylene Oxide	ARGON MEDICAL	75751RGNMD1420R
Ethylene Oxide	ARSYNCO INC.	07072RSYNCFOOTO
Ethylene Oxide	B. BRAUN MEDICAL INC. BURRON MFG. DIV.	18018BRRNM824TW
Ethylene Oxide	BALTIMORE SPICE INC.	21055BLTMR9740R
Ethylene Oxide	BAUSCH & LOMB INC.	29615BSCHL8507P
Ethylene Oxide	BAXTER HEALTHCARE CORP.	29566BXTRHHIGHW
Ethylene Oxide	BAXTER HEALTHCARE CORP.	38732BXTRHHIGHW
Ethylene Oxide	BAXTER HEALTHCARE CORP. PHARMASEAL DIV.	91706BXTRH4401F
Ethylene Oxide	BAXTER HEALTHCARE CORP. SURGICAL GROUP	37604BXTRH2301B
Ethylene Oxide	C. F. SAUER CO.	23220THCFS2000W
Ethylene Oxide	C. R. BARD INC. BARD UROLOGICAL DIV.	30209CRBRD8195N
Ethylene Oxide	C. R. BARD INC. USCI DIV.	01821CRBRD129CO
Ethylene Oxide	CD MEDICAL INC.	33014CDMDC14600
Ethylene Oxide	COBE LABORATORIES INC.	80215CBLBR1201O
Ethylene Oxide	CONCORD PORTEX	03431CNCRD15KIT
Ethylene Oxide	CORDIS CORP.	33014CRDSC14201
Ethylene Oxide	DAVOL INC.	66046DVLNC700EA

112(k) Source Category

Pollutant	Facility Name	TRI ID
Ethylene Oxide	ELECTROMEDICS INC.	80112LCTRM7337S
Ethylene Oxide	ETHICON INC.	76905THCNN3348P
Ethylene Oxide	ETHICON INC.	87125THCNN3801U
Ethylene Oxide	ETHOX CORP.	14204THXCR251SE
Ethylene Oxide	ISOMEDIX OPS. INC.	79936SMDXN1435I
Ethylene Oxide	IVAC CORP.	27522VCCRP100IV
Ethylene Oxide	JOHNSON & JOHNSON HEALTH CARE CO. EASTERN SURGICAL	08902JHNSNUSROU
Ethylene Oxide	JOHNSON & JOHNSON MEDICAL INC.	06489CRTKNWESTQ
Ethylene Oxide	JOHNSON & JOHNSON MEDICAL INC.	75090JHNSNHWY75
Ethylene Oxide	KENDALL CO.	30906KNDLL1816M
Ethylene Oxide	MALLINCKRODT ANESTHESIA PRODUCTS	12809MLLNCHOOKR
Ethylene Oxide	MCCORMICK INGREDIENTS SPICE MILL	21031MCCRM10901
Ethylene Oxide	MEDEX INC.	43026MDXNC3637L
Ethylene Oxide	MEDICAL MFG. CORP.	16510MDCLM2205E
Ethylene Oxide	MEDSURG IND. INC.	22070MDSRG251EX
Ethylene Oxide	NATIONAL MEDICAL CARE MEDICAL PRODS. DIV.	78503NTNLM6620S
Ethylene Oxide	NATIONAL PATENT MEDICAL PARTNERSHIP L.P.	06241NTNLPBOX41
Ethylene Oxide	PROCTER & GAMBLE MFG. CO.	85009HPCPR2050S
Ethylene Oxide	QUALTEX INC. QUALTEX STERILE PRODUCTS DIV.	24281QLTXS100RO
Ethylene Oxide	ROYAL STERILIZATION SYS. INC.	37825QLTXT1601H
Ethylene Oxide	ROYAL STERILIZATION SYS. OF ARIZONA INC.	85621RYLST1370I

112(k) Source Category

Pollutant	Facility Name	TRI ID
Ethylene Oxide	SHERWOOD MEDICAL CO. SHERBURNE PLANT	13460SHRWD108NM
Ethylene Oxide	SHILEY INC.	92714SHLYN17600
Ethylene Oxide	SPECIALTY BRANDS DURKEE-FRENCH PLANT	18018DRKFR1001E
Ethylene Oxide	STERILIZING SERVICES INC.	02864STRLZCUMBE
Ethylene Oxide	U.S. SURGICAL CORP.	06473NTDST195MC
Ethylene Oxide	WEST CO.	17740THWSTCEMET
Ethylene Oxide	ZIMMER INC. PATIENT CARE DIV.	44622ZMMRP200WE

Hydrochloric Acid Production

Pollutant	Facility Name	TRI ID
1,1,2,2-Tetrachloroethane	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15
1,1,2-Trichloroethane	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15
1,3-Butadiene	DU PONT PONTCHARTRAIN WORKS	70069DPNTPHIGHW
1,4-Dichlorobenzene	PPG IND. INC.	26155PPGNDSTATE
Acrylamide	CIBA GEIGY CORP.	36653CBGGYGEIGY
Arsenic Compounds	ISK BIOTECH CORP.	77015FRMNT2239H
Benzene	CONDEA VISTA CO.	21226VSTCH3441F
Benzene	DU PONT PONTCHARTRAIN WORKS	70069DPNTPHIGHW
Benzene	ICI AMERICAS INC. COLD CREEK PLANT	36512CMRCSUSHIG
Benzene	ICI AMERICAS INC. MOUNT PLEASANT PLANT	38474CMRCSMTJOY
Benzene	PPG IND. INC.	26155PPGNDSTATE
Benzene	VELSICOL CHEMICAL CORP.	37409VLSCL4902C
Benzene	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15

112(k) Source Category

Pollutant	Facility Name	TRI ID
Cadmium Compounds	DOVER CHEMICAL CORP. DOVER CHEMICAL CORP.	44622DVRCHWESTF
Carbon Tetrachloride	ALLIED-SIGNAL INC.	90245LLDSG850SO
Carbon Tetrachloride	DOVER CHEMICAL CORP. DOVER CHEMICAL CORP.	44622DVRCHWESTF
Carbon Tetrachloride	DU PONT ANTIOCH WORKS	94509DPNTN6000B
Carbon Tetrachloride	ISK BIOTECH CORP.	77015FRMNT2239H
Carbon Tetrachloride	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15
Chloroform	ALLIED-SIGNAL INC.	90245LLDSG850SO
Chloroform	DU PONT LOUISVILLE PLANT	40216DPNTL4200C
Chloroform	DU PONT MONTAGUE WORKS	49437DPNTMWILKE
Chloroform	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15
Chromium Compounds	ATOCHEM NORTH AMERICA INC.	97208PNNWL6400N
Ethylene Dichloride	FERRO CORP. KEIL CHEMICAL DIV.	46320KLDVS3000S
Ethylene Dichloride	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15
Ethylene Oxide	AKZO CHEMICALS INC.	25515KZCHMSTATE
Ethylene Oxide	ELF ATOCHEM N.A. INC. RIVERVIEW	48192PNNWL4655B
Formaldehyde	AKZO CHEMICALS INC.	25515KZCHMSTATE
Formaldehyde	CIBA GEIGY CORP.	36653CBGGYGEIGY
Formaldehyde	ICI AMERICAS INC. COLD CREEK PLANT	36512CMRCSUSHIG
Mercury Compounds	HOLTRACHEM MFG.	04474LCPCHROUTE
Mercury Compounds	LCP CHEMICALS NORTH CAROLINA	28456LCPCH1INDU
Mercury Compounds	OLIN AUGUSTA PLANT AUGUSTA PLANT	30913LNGST2402L

Appendix B: 1990 TRI Data Extracted Based on a Facility List

112(k) Source Category

Pollutant	Facility Name	TRI ID
Mercury Compounds	OLIN CORP.	37310LNCRPLOWER
Mercury Compounds	PPG IND. INC.	26155PPGNDSTATE
Methyl Chloride	ICI AMERICAS INC. MOUNT PLEASANT PLANT	38474CMRCSMTJOY
Methyl Chloride	ISK BIOTECH CORP.	77015FRMNT2239H
Methylene Chloride	ALLIED-SIGNAL INC.	90245LLDSG850SO
Methylene Chloride	DU PONT ANTIOCH WORKS	94509DPNTN6000B
Methylene Chloride	DU PONT LOUISVILLE PLANT	40216DPNTL4200C
Methylene Chloride	DU PONT MONTAGUE WORKS	49437DPNTMWILKE
Methylene Chloride	PPG IND.	77571PPGND1901A
Methylene Chloride	PPG IND. INC. BARBERTON	44203PPGND4829F
Polycyclic Organic Matter as 16-PAH	CIBA GEIGY CORP.	36653CBGGYGEIGY
Polycyclic Organic Matter as 16-PAH	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15
Tetrachloroethylene	ALLIED-SIGNAL INC.	90245LLDSG850SO
Tetrachloroethylene	DU PONT CORPUS CHRISTI PLANT CORPUS CHRISTI PLANT	78362DPNTCHIGHW
Tetrachloroethylene	DU PONT LOUISVILLE PLANT	40216DPNTL4200C
Tetrachloroethylene	PIONEER CHLOR ALKALI CO. INC.	89015PNRCH8000L
Tetrachloroethylene	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15
Tetrachloroethylene	WITCO CORP. ARGUS DIV.	08865WTCCR2555R
Trichloroethylene	MONSANTO CO.	08014MNSNTROUTE
Trichloroethylene	PPG IND. INC. BARBERTON	44203PPGND4829F
Trichloroethylene	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15

112(k) Source Category

Pollutant	Facility Name	TRI ID
Vinyl Chloride	WESTLAKE MONOMERS CORP.	42029WSTLKHWY15

Integrated Iron and Steel Manufacturing

Pollutant	Facility Name	TRI ID
Benzene	GRANITE CITY STEEL	62040GRNTC20THS
Benzene	INLAND STEEL CO.	46312NLNDS3210W
Benzene	LTV STEEL CO. INC. CLEVELAND WORKS	44127LTVST3100E
Cadmium Compounds	ROUGE STEEL CO.	48121RGSTL3001M
Chromium Compounds	ACME STEEL CO. RIVERDALE FACILITY	60627CMSTL13500
Chromium Compounds	GRANITE CITY STEEL	62040GRNTC20THS
Chromium Compounds	INLAND STEEL CO.	46312NLNDS3210W
Chromium Compounds	LTV STEEL CO. INC.	46312LTVST3001D
Chromium Compounds	LTV STEEL CO. INC. CLEVELAND WORKS	44127LTVST3100E
Chromium Compounds	MCLOUTH STEEL TRENTON PLANT	48183MCLTH1491W
Chromium Compounds	ROUGE STEEL CO.	48121RGSTL3001M
Chromium Compounds	USS FAIRFIELD WORKS	35064SSFRFVALLE
Chromium Compounds	USS MON VALLEY WORKS EDGAR THOMSON PLANT	15104SSDGRBRADD
Chromium Compounds	USS/KOBE STEEL CO.	44055SSLRN1807E
Chromium Compounds	WCI STEEL INC.	44481WRRNW1040P
Chromium Compounds	WEIRTON STEEL CORP.	26062WRTNS400TH
Lead Compounds	ACME STEEL CO. RIVERDALE FACILITY	60627CMSTL13500
Lead Compounds	GRANITE CITY STEEL	62040GRNTC20THS
Lead Compounds	INLAND STEEL CO.	46312NLNDS3210W

112(k) Source Category

Pollutant	Facility Name	TRI ID
Lead Compounds	ROUGE STEEL CO.	48121RGSTL3001M
Lead Compounds	USS/KOBE STEEL CO.	44055SSLRN1807E
Lead Compounds	WCI STEEL INC.	44481WRRNW1040P
Manganese Compounds	ACME STEEL CO. RIVERDALE FACILITY	60627CMSTL13500
Manganese Compounds	GRANITE CITY STEEL	62040GRNTC20THS
Manganese Compounds	INLAND STEEL CO.	46312NLNDS3210W
Manganese Compounds	LTV STEEL CO. INC.	46312LTVST3001D
Manganese Compounds	LTV STEEL CO. INC. CLEVELAND WORKS	44127LTVST3100E
Manganese Compounds	MCLOUTH STEEL TRENTON PLANT	48183MCLTH1491W
Manganese Compounds	USS FAIRFIELD WORKS	35064SSFRFVALLE
Manganese Compounds	USS MON VALLEY WORKS EDGAR THOMSON PLANT	15104SSDGRBRADD
Manganese Compounds	USS/KOBE STEEL CO.	44055SSLRN1807E
Manganese Compounds	WCI STEEL INC.	44481WRRNW1040P
Manganese Compounds	WEIRTON STEEL CORP.	26062WRTNS400TH
Nickel Compounds	ACME STEEL CO. RIVERDALE FACILITY	60627CMSTL13500
Nickel Compounds	GRANITE CITY STEEL	62040GRNTC20THS
Nickel Compounds	INLAND STEEL CO.	46312NLNDS3210W
Nickel Compounds	ROUGE STEEL CO.	48121RGSTL3001M
Nickel Compounds	USS MON VALLEY WORKS EDGAR THOMSON PLANT	15104SSDGRBRADD
Nickel Compounds	USS/KOBE STEEL CO.	44055SSLRN1807E
Nickel Compounds	WCI STEEL INC.	44481WRRNW1040P

112(k) Source Category

Pollutant	Facility Name	TRI ID
Polycyclic Organic Matter as 16-PAH	GRANITE CITY STEEL	62040GRNTC20THS
Polycyclic Organic Matter as 16-PAH	INLAND STEEL CO.	46312NLNDS3210W
Polycyclic Organic Matter as 16-PAH	LTV STEEL CO. INC. CLEVELAND WORKS	44127LTVST3100E
Quinoline	INLAND STEEL CO.	46312NLNDS3210W
Quinoline	LTV STEEL CO. INC. CLEVELAND WORKS	44127LTVST3100E
Styrene	GRANITE CITY STEEL	62040GRNTC20THS
Styrene	INLAND STEEL CO.	46312NLNDS3210W
Styrene	LTV STEEL CO. INC. CLEVELAND WORKS	44127LTVST3100E
Tetrachloroethylene	INLAND STEEL CO.	46312NLNDS3210W
Tetrachloroethylene	LTV STEEL CO. INC. CLEVELAND WORKS	44127LTVST3100E

Leather Tanning and Finishing Operations

Pollutant	Facility Name	TRI ID
Chromium Compounds	ALLIED SPLIT CORP.	12095LLDLT422NO
Chromium Compounds	BLACKHAWK LEATHER LTD.	53204BLCKH1000W
Chromium Compounds	CUDAHY TANNING CO.	53110CDHYT5043S
Chromium Compounds	EAGLE OTTAWA LEATHER CO.	49417GLTTW200NB
Chromium Compounds	EAGLE TANNING CO.	50703GLTNN4455R
Chromium Compounds	GARDEN STATE TANNING READING	19601CHSTN2NDCH
Chromium Compounds	GEBHARDT-VOGEL TANNING CO.	53204GBHRD1228W
Chromium Compounds	GEBHARDT-VOGEL TANNING CO.	53233GBHRD2615W
Chromium Compounds	KARG BROTHERS INC.	12095KRGBR620EA
Chromium Compounds	MERCERSBURG TANNING CO.	17236LWNGR209OR

112(k) Source Category

Pollutant	Facility Name	TRI ID
Chromium Compounds	PAN AMERICAN TANNING CORP.	12078PNMRC318WE
Chromium Compounds	PFISTER & VOGEL TANNING CO.	53202PFSTR1531N
Chromium Compounds	S. B. FOOT TANNING CO.	55066SBFTTBENCH
Chromium Compounds	SALZ LEATHERS INC.	95060SLZLT1040R
Chromium Compounds	SAWYER OF NAPA	94559SWYRF68COO
Chromium Compounds	WESTERN TANNING INC.	81416WSTRN1454H
Chromium Compounds	WOLVERINE LEATHERS	49341TNNRY123NO
Formaldehyde	JBF. IND. INC.	12078JBFND41WES
Tetrachloroethylene	ACME SPONGE & CHAMOIS CO. INC.	34689CMSPN855EP
Tetrachloroethylene	SAWYER OF NAPA	94559SWYRF68COO

Metal Coil (Surface Coating)

Pollutant	Facility Name	TRI ID
Chromium Compounds	ALUMAX MILL PRODS. INC.	17604LMXML1480M
Chromium Compounds	ALUMAX MILL PRODS. INC.	75501LMXML300AL
Chromium Compounds	ARMCO INC. ZANESVILLE OPS.	43701RMCDV1724L
Chromium Compounds	CHESAPEAKE FINISHED METALS INC.	21227CHSPK6754S
Chromium Compounds	CHICAGO FINISHED METALS INC.	60455CHCGF9900I
Chromium Compounds	COMMONWEALTH ALUMINUM CORP.	42351CMMNWKYHWY
Chromium Compounds	HOWMET CORP.	76307HWMTC6200C
Chromium Compounds	KAISER ALUMINUM & CHEMICAL TRENTWOOD WORKS	99215KSRLME1500
Chromium Compounds	LOGAN ALUMINUM INC.	42276LGNLMPOBOX
Chromium Compounds	PRECOAT METALS	60632PRCTM4800S

112(k) Source Category

Pollutant	Facility Name	TRI ID
Chromium Compounds	PRECOAT METALS	62040PRCTM25NOR
Chromium Compounds	PRECOAT METALS	77015PRCTM16402
Chromium Compounds	REYNOLDS METALS CO. ALLOYS PLANT	35660RYNLDEAST2
Chromium Compounds	ROLL COATER INC.	46140RLLCT3398E
Chromium Compounds	ROLL COATER INC.	46345RLLCT2NDAN
Formaldehyde	PRECOAT METALS	63116PRCTM4301S
Lead Compounds	ALUCOBOND TECHS. INC.	42025LCBNDSYMSO
Lead Compounds	ROLL COATER INC.	46345RLLCT2NDAN
Manganese Compounds	ALCOA LEBANON WORKS	17042LMNMC3000S
Manganese Compounds	ALCOA WARRICK OPERATIONS	47630LMNMCHIGHW
Manganese Compounds	ALUMAX MILL PRODS. INC.	17604LMXML1480M
Manganese Compounds	COMMONWEALTH ALUMINUM CORP.	42351CMMNWKYHWY
Manganese Compounds	CONSOLIDATED ALUMINUM CORP.	38301CNSLDCONAL
Manganese Compounds	KAISER ALUMINUM & CHEMICAL TRENTWOOD WORKS	99215KSRLME1500
Manganese Compounds	LOGAN ALUMINUM INC.	42276LGNLMPOBOX
Manganese Compounds	REYNOLDS METALS CO. ALLOYS PLANT	35660RYNLDEAST2
Methylene Chloride	E. G. SMITH CONSTRUCTION PRODUCTS INC.	43725GSMTH530NO
Methylene Diphenyl Diisocyanate	E. G. SMITH CONSTRUCTION PRODUCTS INC.	43725GSMTH530NO
Nickel Compounds	AMERICAN NICKELOID CO.	18088MRCNNCHERR
Nickel Compounds	ARMCO INC. ZANESVILLE OPS.	43701RMCDV1724L
Nickel Compounds	HOWMET CORP.	76307HWMTC6200C

112(k) Source Category

Pollutant	Facility Name	TRI ID
Nickel Compounds	WALBRIDGE COATINGS	43465WLBRD30610
Polycyclic Organic Matter as 16-PAH	COIL COATERS OF AMERICA INC.	30059CLCTR2030R
Polycyclic Organic Matter as 16-PAH	CONSOLIDATED ALUMINUM CORP.	38301CNSLDCONAL
Polycyclic Organic Matter as 16-PAH	ENAMEL PRODS. & PLATING CO.	46368NMLPRUSHWY
Polycyclic Organic Matter as 16-PAH	NICHOLS HOMESHIELD INC.	52808NCHLS1725R
Polycyclic Organic Matter as 16-PAH	STOLLE CORP. PLANT 3	45365THST32615C

Plywood/Particle Board Manufacturing

Pollutant	Facility Name	TRI ID
Acetaldehyde	GEORGIA-PACIFIC CORP.	38655GRGPCOLDHW
Arsenic Compounds	ANTHONY WOOD TREATING INC.	71801NTHNYWESTA
Arsenic Compounds	COASTAL LUMBER CO.	32333CSTLLHIGHW
Arsenic Compounds	WEYERHAEUSER CO.	35576WYRHSPOBOX
Arsenic Compounds	WILLAMETTE IND. INC. ZWOLLE DIV.	71486WLLMTLAHWY
Chromium Compounds	ANTHONY WOOD TREATING INC.	71801NTHNYWESTA
Chromium Compounds	COASTAL LUMBER CO.	32333CSTLLHIGHW
Chromium Compounds	WEYERHAEUSER CO.	35576WYRHSPOBOX
Chromium Compounds	WILLAMETTE IND. INC. ZWOLLE DIV.	71486WLLMTLAHWY
Formaldehyde	ABITIBI-PRICE CORP. ALPENA PLANT	49707BTBPR416FO
Formaldehyde	ABT CO. INC.	28669BTBPRHWY26
Formaldehyde	ALLEGHENY PARTICLEBOARD L.P.	16735LLGHNHUTCH
Formaldehyde	BOHEMIA INC. MDF PLANT	95677BHMMD4300D
Formaldehyde	BOISE CASCADE PARTICLEBOARD PLANT	97850SLNDCHWY82

112(k) Source Category

Pollutant	Facility Name	TRI ID
Formaldehyde	CHAMPION INTERNATIONAL CORP.	75934CHMPNFARMR
Formaldehyde	CHAMPION INTL. CORP.	75939CHMPNPLANT
Formaldehyde	GEORGIA-PACIFIC CORP.	38655GRGPCOLDHW
Formaldehyde	GEORGIA-PACIFIC CORP. (GAYLORD PARTICLEBOARD)	49735GRGPC2212D
Formaldehyde	GEORGIA-PACIFIC CORP. CATAWBA HARDBOARD	29704GRGPC5260C
Formaldehyde	GEORGIA-PACIFIC CORP. COMPLEX	28333GRGPCOLDMO
Formaldehyde	GEORGIA-PACIFIC CORP. CONWAY HARDBOARD	27820GRGPCAMPAA
Formaldehyde	GEORGIA-PACIFIC CORP. FORDYCE PLYWOOD	71742GRGPC600WE
Formaldehyde	GEORGIA-PACIFIC CORP. HOLLY HILL FIBERBOARD	29059GRGPCHIGHW
Formaldehyde	GEORGIA-PACIFIC CORP. LEBANON HARDBOARD PLANT	97355GRGPC37680
Formaldehyde	GEORGIA-PACIFIC CORP. MADISON PLYWOOD	30650GRGPC4891M
Formaldehyde	GEORGIA-PACIFIC CORP. PARTICLEBOARD	39168GRGPCHWY28
Formaldehyde	GEORGIA-PACIFIC CORP. PLYWOOD & CHIP-N-SAW FACILITIE	29127GRGPCHIGHW
Formaldehyde	GEORGIA-PACIFIC CORP. PLYWOOD PLANT	35160GRGPCIRONA
Formaldehyde	GEORGIA-PACIFIC CORP. PLYWOOD PLANT	39339GRGPCHWY1A
Formaldehyde	GEORGIA-PACIFIC CORP. SKIPPERS OSB	23879GRGPCUS301
Formaldehyde	GEORGIA-PACIFIC CORP. WHITEVILLE PLYWOOD	28472GRGPCSECON
Formaldehyde	GEORGIA-PACIFIC RESINS INC.	71635GRGPCHWY8A
Formaldehyde	GEORGIA-PACIFIC SAVANNAH PLYWOOD	31498GRGPCOLDLO
Formaldehyde	INTERNATIONAL PAPER	27882MSNTCSTATE
Formaldehyde	INTERNATIONAL PAPER CO.	23890MSNTC721WE

112(k) Source Category

Pollutant	Facility Name	TRI ID
Formaldehyde	INTERNATIONAL PAPER CO.	75963NTRNT2301S
Formaldehyde	J. M. HUBER CORP.	04740JMHBRPOBOX
Formaldehyde	J. M. HUBER CORP.	30529JMHBRPOBOX
Formaldehyde	JELD-WEN FIBER OF WASHINGTON	98952JLDWNCORNE
Formaldehyde	LEA LUMBER & PLYWOOD CO.	27983LLMBRRTE3B
Formaldehyde	LOUISIANA-PACIFIC CORP.	30603LSNPCPOBOX
Formaldehyde	LOUISIANA-PACIFIC CORP.	49868LSNPC461MI
Formaldehyde	LOUISIANA-PACIFIC CORP.	49881LSNPCHWYM9
Formaldehyde	LOUISIANA-PACIFIC CORP.	54843LSNPCRT8GE
Formaldehyde	LOUISIANA-PACIFIC CORP.	55616LSNPCINDUS
Formaldehyde	LOUISIANA-PACIFIC CORP.	59802LSNPC3300R
Formaldehyde	LOUISIANA-PACIFIC CORP.	75936LSNPC1MINO
Formaldehyde	LOUISIANA-PACIFIC CORP.	80459LSNPCHWY50
Formaldehyde	LOUISIANA-PACIFIC CORP.	83858LSNPCNORTH
Formaldehyde	LOUISIANA-PACIFIC CORP. ARCATA PARTICLEBOARD	95521LSNPCARLIN
Formaldehyde	LOUISIANA-PACIFIC CORP. KIRBY FOREST INDUSTRIES	75928LSNPCRT1
Formaldehyde	LOUISIANA-PACIFIC CORP. KIRBY FOREST INDUSTRIES	77327LSNPCRT1
Formaldehyde	LOUISIANA-PACIFIC CORP. OROVILLE HARDBOARD	95965LSNPCMERLO
Formaldehyde	LOUISIANA-PACIFIC CORP. PLYWOOD	71049LSNPCHWY5N
Formaldehyde	LOUISIANA-PACIFIC CORP. PLYWOOD	75901LSNPCOLDMI
Formaldehyde	LOUISIANA-PACIFIC CORP. URANI	71480LSNPC165N

Appendix B: 1990 TRI Data Extracted Based on a Facility List

112(k) Source Category

Pollutant	Facility Name	TRI ID
Formaldehyde	LOUISIANA-PACIFIC MDF	35016LSNPCWHITE
Formaldehyde	MANVILLE FOREST PRODUCTS JOYCE FACILITY	71440MNVLLHWY34
Formaldehyde	MARTCO. PARTNERSHIP	71347MRTCPUSHWY
Formaldehyde	MASONITE CORP. BUILDING INDL. PRODS. GROUP	39440MSNTCSOUTH
Formaldehyde	MASONITE CORP. MARION PLANT	29592MSNTCHIGHW
Formaldehyde	MASONITE CORP. STUART PLANT	24171MSNTCCOMME
Formaldehyde	MEDITE CORP. MEDFORD DIV.	97501MDTCR2685N
Formaldehyde	MERILLAT INDUSTRIES INC.	57709MRLLT4300S
Formaldehyde	MONROEVILLE PARTICLEBOARD PLANT	36460MNRVLTEMPL
Formaldehyde	NORBORD INDUSTRIES INC.	13754MDFTCLAURE
Formaldehyde	NORTHWOOD PANELBOARD CO.	56678NRTHWCOUNT
Formaldehyde	PLUM CREEK MFG. L.P. EVERGREEN PLYWOOD DIV.	59901PLMCR75SUN
Formaldehyde	PLUM CREEK MFG. L.P. MDF DIV.	59912PLMCRPOBOX
Formaldehyde	POTLATCH CORP.	55744BLNDN502CO
Formaldehyde	POTLATCH CORP.	56601PTLTCRT3BO
Formaldehyde	POTLATCH CORP. OXBOARD PLANT	55723PTLTCPOBOX
Formaldehyde	ROSEBURG FOREST PRODS.	97470RSBRGHIGHW
Formaldehyde	RUTLAND PLYWOOD CORP.	05701RTLNDRIPLE
Formaldehyde	SMURFIT NEWSPRINT CORP.	97370SMRFT351N1
Formaldehyde	SMURFIT NEWSPRINT CORP. SWEET HOME PLANT	97386SMRFT14001
Formaldehyde	SUPERWOOD CORP. LIONITE HARDBOARD DIV.	54555LNTHRHWY13

112(k) Source Category

Pollutant	Facility Name	TRI ID
Formaldehyde	TEMPLE-INLAND FOREST PRODS. CORP.	30824THMSNOLDTA
Formaldehyde	TIMBER PRODS. CO.	97501TMBRP25EAS
Formaldehyde	TIMBER PRODS. CO. DBA TIM-PLY	97526TMBRP125MI
Formaldehyde	TIMBER PRODS. CO. DBA WHITE CITY PLYWOOD	97503TMBRP8380A
Formaldehyde	TRIWOOD INC.	24148TRWDNSTATE
Formaldehyde	TRUS JOIST CORP.	31603TRSJS410CL
Formaldehyde	TRUS JOIST MACMILLAN	97402TRSJS195NB
Formaldehyde	UNION CAMP CORP.	36015NNCMPUSHIG
Formaldehyde	WEYERHAEUSER CO.	27559WYRHSSTATE
Formaldehyde	WEYERHAEUSER CO.	28621WYRHSRT3OF
Formaldehyde	WEYERHAEUSER CO.	49738WYRHS4111E
Formaldehyde	WEYERHAEUSER CO.	54449WYRHS1401E
Formaldehyde	WEYERHAEUSER CO.	71833WYRHSHIGHW
Formaldehyde	WEYERHAEUSER CO.	71956WYRHSPOBOX
Formaldehyde	WEYERHAEUSER PARTICLEBOARD MILL	31620WYRHS801CO
Formaldehyde	WILLAMETTE IND. INC. KORPINE DIV.	97702WLLMT55SWD
Formaldehyde	WILLAMETTE IND. INC. LILLIE DIV.	71256WLLMTHIGHW
Formaldehyde	WILLAMETTE IND. INC. MALVERN DIV.	72104WLLMTROUTE
Formaldehyde	WILLAMETTE INDUSTRIES INC. SUREPINE DIV.	71275WLLMTLINCO
Methylene Diphenyl Diisocyanate	LOUISIANA-PACIFIC CORP.	30603LSNPCPOBOX
Methylene Diphenyl Diisocyanate	LOUISIANA-PACIFIC CORP.	49868LSNPC461MI

Appendix B: 1990 TRI Data Extracted Based on a Facility List

112(k) Source Category

Pollutant	Facility Name	TRI ID
Methylene Diphenyl Diisocyanate	LOUISIANA-PACIFIC CORP.	49881LSNPCHWYM9
Methylene Diphenyl Diisocyanate	LOUISIANA-PACIFIC CORP.	54843LSNPCRT8GE
Methylene Diphenyl Diisocyanate	LOUISIANA-PACIFIC CORP.	55616LSNPCINDUS
Methylene Diphenyl Diisocyanate	LOUISIANA-PACIFIC CORP.	80459LSNPCHWY50
Methylene Diphenyl Diisocyanate	LOUISIANA-PACIFIC CORP.	83858LSNPCNORTH
Methylene Diphenyl Diisocyanate	LOUISIANA-PACIFIC CORP. URANI	71480LSNPC165N
Methylene Diphenyl Diisocyanate	MEDITE CORP. MEDFORD DIV.	97501MDTCR2685N
Methylene Diphenyl Diisocyanate	WILLAMETTE VALLEY CO.	97402WLLMT586MC
Styrene	HUGHES BROTHERS INC.	68434HGHSB210NO
Styrene	LOUISIANA-PACIFIC CORP.	59802LSNPC3300R
Styrene	WEYERHAEUSER CO.	27559WYRHSSTATE
Tetrachloroethylene	HIGH POINT CHEMICAL CORP.	27261HGHPN255BE
Tetrachloroethylene	MASONITE CORP. BUILDING INDL. PRODS. GROUP	39440MSNTCSOUTH
Trichloroethylene	EVANITE FIBER CORP. BATTERY SEPARATOR DIV.	97333VNTFB1030S

Primary Lead Smelting

Pollutant	Facility Name	TRI ID
Arsenic Compounds	ASARCO INC. E. HELENA PLANT	59635SRCNCSMELT
Arsenic Compounds	ASARCO INC. GLOVER PLANT	63646SRCNCHIGHW
Arsenic Compounds	DOE RUN CO. HERCULANEUM SMELTER	63048HRCLN881MA
Cadmium Compounds	ASARCO INC. E. HELENA PLANT	59635SRCNCSMELT
Cadmium Compounds	ASARCO INC. GLOVER PLANT	63646SRCNCHIGHW
Cadmium Compounds	DOE RUN CO. HERCULANEUM SMELTER	63048HRCLN881MA

Appendix B: 1990 TRI Data Extracted Based on a Facility List

112(k) Source Category

Pollutant	Facility Name	TRI ID
Chromium Compounds	DOE RUN CO. HERCULANEUM SMELTER	63048HRCLN881MA
Lead Compounds	ASARCO INC. E. HELENA PLANT	59635SRCNCSMELT
Lead Compounds	DOE RUN CO. HERCULANEUM SMELTER	63048HRCLN881MA
Manganese Compounds	ASARCO INC. E. HELENA PLANT	59635SRCNCSMELT
Nickel Compounds	ASARCO INC. E. HELENA PLANT	59635SRCNCSMELT
Nickel Compounds	ASARCO INC. GLOVER PLANT	63646SRCNCHIGHW
Nickel Compounds	DOE RUN CO. HERCULANEUM SMELTER	63048HRCLN881MA

Reinforced Plastic Composites Production

Pollutant	Facility Name	TRI ID
1,3-Butadiene	ANDERSON DEVELOPMENT CO.	46404NDRSN3400W
1,3-Butadiene	STANLEY ELECTRIC U.S. CO. INC.	43140STNLY1627S
Acrylonitrile	ANDERSON DEVELOPMENT CO.	46404NDRSN3400W
Acrylonitrile	GRANT & ROTH PLASTICS INC.	97124GRNTR1600N
bis(2-Ethylhexyl)phthalate	BRUNSWICK BOWLING BRUNSWICK DIV.	49443BRNSW525WL
bis(2-Ethylhexyl)phthalate	FABALL ENTS. OF MARYLAND INC.	21224FBLLN2200F
Cadmium Compounds	ELECTROCHEMICAL CO. INC.	17404LCTRC1600P
Chromium Compounds	AK IND. INC.	46563KNDST2055P
Chromium Compounds	BOEING DEFENSE & SPACE GROUP PLANT II	98108BNGRS7755E
Chromium Compounds	GREAT DANE TRAILERS INC.	47834GRTDNUSHIG
Chromium Compounds	KEELER BRASS AUTOMOTIVE	49508KLRBR29293
Chromium Compounds	POLYCOM HUNTSMAN INC. DONORA PLANT 1	15033PLYCMWASHI
Chromium Compounds	POLYMER CONCRETE CORP.	48122PLYMR17675

112(k) Source Category

Pollutant	Facility Name	TRI ID
Chromium Compounds	TRICO TECH. CORP.	78521TRCTC1995B
Ethyl Acrylate	EMULSION SYSTEMS OF ILLINOIS INC.	60439MLSNSEASTO
Ethyl Acrylate	INTERPOLYMER CORP.	02021NTRPL330PI
Ethyl Acrylate	INTERPOLYMER CORP.	40258NTRPL7501D
Lead Compounds	MAGNETEK INC.	39114MGNTKHWY49
Lead Compounds	POLYCOM HUNTSMAN INC. DONORA PLANT 1	15033PLYCMWASHI
Lead Compounds	POLYMER CONCRETE CORP.	48122PLYMR17675
Lead Compounds	WREX PRODUCTS INC.	95928WRXPR25WRE
Manganese Compounds	AK IND. INC.	46563KNDST2055P
Manganese Compounds	BLACK & DECKER U.S. POWER TOOLS GROUP	28306BLCKDHWY30
Manganese Compounds	F. E. MYERS A PENTAIR CO.	44805FMYRS1101M
Manganese Compounds	KENWORTH TRUCK CO.	98108KNWRT8801E
Manganese Compounds	KRUEGER INTERNATIONAL INC.	54308KRGRN1330B
Methylene Diphenyl Diisocyanate	AEROQUIP INOAC CO.	43420STRLN1410M
Methylene Diphenyl Diisocyanate	AMERICAN SPA MFG. CO.	97071MRCNS13201
Methylene Diphenyl Diisocyanate	ARCTCO. INC.	56701RCTCN600BR
Methylene Diphenyl Diisocyanate	BRUNSWICK BOWLING BRUNSWICK DIV.	49443BRNSW525WL
Methylene Diphenyl Diisocyanate	COMPOSITE TECHNOLOGY INC. CONN	76131CMPST1005B
Methylene Diphenyl Diisocyanate	DIVERSIFIED PRODS. CORP.	36803DVRSF309WI
Methylene Diphenyl Diisocyanate	DM IND.	33054DMNDS2320N
Methylene Diphenyl Diisocyanate	EBONITE INTERNATIONAL	42240BNTNTHWY68

112(k) Source Category

Pollutant	Facility Name	TRI ID
Methylene Diphenyl Diisocyanate	FABALL ENTS. OF MARYLAND INC.	21224FBLLN2200F
Methylene Diphenyl Diisocyanate	GREAT DANE TRAILERS INC.	47834GRTDNUSHIG
Methylene Diphenyl Diisocyanate	HACKNEY BROTHERS INC.	27893HCKNY301NP
Methylene Diphenyl Diisocyanate	JASPER PLASTICS/TOOL PRO	47546JSPRPW12TH
Methylene Diphenyl Diisocyanate	NAVISTAR INTL. TRANSPORTATION CORP. CPO	43228NVSTR800MA
Methylene Diphenyl Diisocyanate	SILVESTRI STUDIO INC.	92645SLVST1733C
Methylene Diphenyl Diisocyanate	WATER HEATER INNOVATIONS INC.	55121WTRHT3107S
Methylene Diphenyl Diisocyanate	WAUSAUKEE INC.	54177WSKNCCEDAR
Nickel Compounds	KEELER BRASS AUTOMOTIVE	49508KLRBR29293
Nickel Compounds	TRICO TECH. CORP.	78521TRCTC1995B
Tetrachloroethylene	BOEING DEFENSE & SPACE GROUP PLANT II	98108BNGRS7755E
Tetrachloroethylene	GENERAL FIBERGLASS SUPPLY EPIC RESINS DIV.	53186PCRSN1415E
Tetrachloroethylene	UNITED TECHS. MOTOR SYS.	39704NTDTCMCCRA

Shipbuilding and Ship Repair (Surface Coating)

Pollutant	Facility Name	TRI ID
Acrylonitrile	NEWPARK SHIPBUILDING & REPAIR INC.	77262NWPRK8502C
Chromium Compounds	BATH IRON WORKS CORP.	04530BTHRN700WA
Chromium Compounds	GUNDERSON INC.	97210GNDRS4350N
Chromium Compounds	INGALLS SHIPBUILDING INC.	39568NGLLSLITTO
Chromium Compounds	NORSHIPCO	23504NRFLKROSEC
Ethylene Dichloride	NEWPARK SHIPBUILDING & REPAIR INC.	77262NWPRK8502C
Lead Compounds	GENERAL DYNAMICS CORP. ELECTRIC BOAT DIV.	06340GNRLD75EAS

Appendix B: 1990 TRI Data Extracted Based on a Facility List

112(k) Source Category

Pollutant	Facility Name	TRI ID
Lead Compounds	INGALLS SHIPBUILDING INC.	39568NGLLSLITTO
Lead Compounds	NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.	23607NWPRT4101W
Manganese Compounds	BATH IRON WORKS CORP.	04530BTHRN700WA
Manganese Compounds	GENERAL DYNAMICS CORP. ELECTRIC BOAT DIV.	06340GNRLD75EAS
Manganese Compounds	GUNDERSON INC.	97210GNDRS4350N
Manganese Compounds	INGALLS SHIPBUILDING INC.	39568NGLLSLITTO
Manganese Compounds	JEFFBOAT	47130JFFBT1030E
Manganese Compounds	NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.	23607NWPRT4101W
Manganese Compounds	NORSHIPCO	23504NRFLKROSEC
Methylene Chloride	NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.	23607NWPRT4101W
Nickel Compounds	BATH IRON WORKS CORP.	04530BTHRN700WA
Nickel Compounds	GENERAL DYNAMICS CORP. ELECTRIC BOAT DIV.	06340GNRLD75EAS
Nickel Compounds	GUNDERSON INC.	97210GNDRS4350N
Nickel Compounds	INGALLS SHIPBUILDING INC.	39568NGLLSLITTO
Nickel Compounds	NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.	23607NWPRT4101W
Nickel Compounds	NORSHIPCO	23504NRFLKROSEC
Polycyclic Organic Matter as 16-PAH	BATH IRON WORKS CORP.	04530BTHRN700WA
Trichloroethylene	JEFFBOAT	47130JFFBT1030E
Trichloroethylene	NEWPORT NEWS SHIPBUILDING & DRY DOCK CO.	23607NWPRT4101W

Stainless and Non-stainless Steel Manufacture - EAF

Beryllium Compounds	LUKENS STEEL CO.	19320LKNSSMODEN

112(k) Source Category

Pollutant	Facility Name	TRI ID
Cadmium Compounds	BIRMINGHAM STEEL CORP. BIRMINGHAM ALABAMA STEEL DIV.	35234BRMNG4301F
Cadmium Compounds	BIRMINGHAM STEEL CORP. JACKSON MISSISSIPPI STEEL DIV.	39208BSCSTFOURT
Cadmium Compounds	BIRMINGHAM STEEL CORP. KANKAKEE ILLINOIS STEEL DIV.	60914BRMNGRR1BO
Cadmium Compounds	CASCADE STEEL ROLLING MILLS INC.	97128CSCDS3200N
Cadmium Compounds	CITISTEEL USA INC.	19703CTSTL4001P
Cadmium Compounds	INTERNATIONAL METALS RECLAMATION CO.	16117NTRNTSR488
Cadmium Compounds	LUKENS STEEL CO.	19320LKNSSMODEN
Cadmium Compounds	NEWPORT STEEL CORP.	41071NWPRTLICKI
Cadmium Compounds	NUCOR STEEL UTAH DIV.	84330NCRST7285W
Cadmium Compounds	ROANOKE ELECTRIC STEEL CORP.	24017RNKLC102WE
Cadmium Compounds	SHEFFIELD STEEL CORP.	74063SHFFL2300S
Chromium Compounds	A. FINKL & SONS CO.	60614FNKLS2011S
Chromium Compounds	ABC RAIL PRODS. CORP.	35040BCRLC14THS
Chromium Compounds	AL TECH SPECIALTY STEEL CORP.	12189LTCHSSPRIN
Chromium Compounds	ALLEGHENY LUDLUM CORP.	14094LLGHN695OH
Chromium Compounds	ALLEGHENY LUDLUM CORP.	15014LLGHNRIVER
Chromium Compounds	AMERICAN CAST IRON PIPE CO.	35207MRCNC2930N
Chromium Compounds	ARKANSAS STEEL ASSOC.	72112RKNSSVANDY
Chromium Compounds	ARMCO INC. BUTLER OPS.	16001RMCDVBANTA
Chromium Compounds	AUBURN STEEL CO. INC.	13021BRNSTQUARR
Chromium Compounds	BAYOU STEEL CORP.	70069BYSTLRIVER

Appendix B: 1990 TRI Data Extracted Based on a Facility List

112(k) Source Category

Pollutant	Facility Name	TRI ID
Chromium Compounds	BETHLEHEM STEEL CORP. BAR ROD & WIRE DIV. (FRANKLIN)	15907FRNKL119WA
Chromium Compounds	BETHLEHEM STEEL CORP. STEELTON PLANT	17113BTHLHFRONT
Chromium Compounds	BIG THREE INDUSTRIAL GAS INC. SHARON ASP	16121SHRNSROEME
Chromium Compounds	BIRMINGHAM STEEL CORP. BIRMINGHAM ALABAMA STEEL DIV.	35234BRMNG4301F
Chromium Compounds	BIRMINGHAM STEEL CORP. JACKSON MISSISSIPPI STEEL DIV.	39208BSCSTFOURT
Chromium Compounds	BIRMINGHAM STEEL CORP. KANKAKEE ILLINOIS STEEL DIV.	60914BRMNGRR1BO
Chromium Compounds	BRIDGEVILLE STAINLESS & ALLOY PRODUCTS	15017CYTMPMAYER
Chromium Compounds	CARPENTER TECHNOLOGY CORP.	19612CRPNT101WB
Chromium Compounds	CASCADE STEEL ROLLING MILLS INC.	97128CSCDS3200N
Chromium Compounds	CITISTEEL USA INC.	19703CTSTL4001P
Chromium Compounds	CO-STEEL RARITAN	08862RRTNR225EL
Chromium Compounds	COPPERWELD STEEL CO.	44482CPPRW4000M
Chromium Compounds	CRUCIBLE SPECIALTY METALS SPECIALTY METALS DIV.	13209CRCBLSTATE
Chromium Compounds	EASTERN STAINLESS CORP.	21224STRNS7700R
Chromium Compounds	ELECTRALLOY CORP.	16301LCTRL175MA
Chromium Compounds	ELLWOOD UDDEHOLM STEEL CO.	16101LLWDD700MO
Chromium Compounds	EMPIRE-DETROIT STEEL DIV. DETROIT DIV.	44901MPRDT913BO
Chromium Compounds	ESCO CORP.	39345SCCRPHIGHW
Chromium Compounds	ESCO CORP.	97210SCCRP2141N
Chromium Compounds	FIRSTMISS STEEL INC.	15935FRSTMRTE60
Chromium Compounds	FLORIDA STEEL CORP.	28213FLRDSHWY11

112(k) Source Category

Pollutant	Facility Name	TRI ID
Chromium Compounds	FLORIDA STEEL CORP.	38305FLRDSUSHIG
Chromium Compounds	FLORIDA STEEL CORP. JACKSONVILLE MILL DIV.	32234FLRDSHWY21
Chromium Compounds	FLORIDA STEEL CORP. KNOXVILLE RF	37921FLRDS1919T
Chromium Compounds	GEORGETOWN STEEL CORP.	29442GRGTWSOUTH
Chromium Compounds	GREEN RIVER STEEL CORP.	42303GRNRV4701U
Chromium Compounds	HARRISON STEEL CASTINGS CO.	47918HRRSN900MO
Chromium Compounds	HAYNES INTERNATIONAL INC.	46902HYNSN1020W
Chromium Compounds	HOEGANAES CORP.	08077HGNSCRIVER
Chromium Compounds	INTERNATIONAL METALS RECLAMATION CO.	16117NTRNTSR488
Chromium Compounds	IPSCO STEEL INC.	52730PSCST18457
Chromium Compounds	IRI INTERNATIONAL CORP.	79066RNTRN5MILE
Chromium Compounds	J & L SPECIALTY STEEL INC.	15059JLSPC12THS
Chromium Compounds	KENTUCKY ELECTRIC STEEL CORP.	41105KNTCKUS60W
Chromium Compounds	KEOKUK STEEL CASTINGS HAWKEYE DIV.	52632KKKST240RO
Chromium Compounds	LACLEDE STEEL CO.	62002LCLDSCUTST
Chromium Compounds	LATROBE STEEL CO.	15650LTRBS2626L
Chromium Compounds	LONE STAR STEEL CO.	75668LNSTRHWY25
Chromium Compounds	LUKENS STEEL CO.	19320LKNSSMODEN
Chromium Compounds	MARATHON LETOURNEAU CO.	75601MRTHN2400S
Chromium Compounds	MAYNARD STEEL CASTING CO.	53215MYNRD2856S
Chromium Compounds	NATIONAL FORGE CO.	16329NTNLF1FRON

112(k) Source Category

Pollutant	Facility Name	TRI ID
Chromium Compounds	NEWPORT STEEL CORP.	41071NWPRTLICKI
Chromium Compounds	NORTH STAR STEEL CO. IOWA	52778NRTHSHWY38
Chromium Compounds	NORTH STAR STEEL CO. MICHIGAN	48161NRTHS3000E
Chromium Compounds	NORTH STAR STEEL CO. MINNESOTA DIV.	55119NRTHS1678R
Chromium Compounds	NORTH STAR STEEL OHIO	44510NRTHS2669W
Chromium Compounds	NORTH STAR STEEL TEXAS	77701NRTHSOLDHI
Chromium Compounds	NORTHWESTERN STEEL & WIRE CO.	61081NRTHW121WA
Chromium Compounds	NUCOR STEEL	47933NCRST400SO
Chromium Compounds	NUCOR STEEL	75846NCRSTHWY79
Chromium Compounds	NUCOR STEEL UTAH DIV.	84330NCRST7285W
Chromium Compounds	NUCOR-YAMATO STEEL CO.	72310NCRYMHWY18
Chromium Compounds	OREGON STEEL MILLS INC.	97203RGNST14400
Chromium Compounds	REPUBLIC ENGINEERED STEELS CANTON PLANT	44704LTVST26338
Chromium Compounds	ROANOKE ELECTRIC STEEL CORP.	24017RNKLC102WE
Chromium Compounds	ROCKWELL INTERNATIONAL OHP&D DIV.	66002RCKWL4THAN
Chromium Compounds	SANDUSKY FOUNDRY & MACHINE CO.	44871SNDSK615WE
Chromium Compounds	SHEFFIELD STEEL CORP.	74063SHFFL2300S
Chromium Compounds	SLATER STEELS FORT WAYNE SP ALLOYS DIV.	46801SLTRS2400T
Chromium Compounds	SMI STEEL INC.	35212SMSTLPOBOX
Chromium Compounds	STANDARD STEEL	15650STNDR107GE
Chromium Compounds	STANDARD STEEL	17009STNDR500WA

112(k) Source Category

Pollutant	Facility Name	TRI ID
Chromium Compounds	STRUCTURAL METALS INC.	78156STRCTPOBOX
Chromium Compounds	SWVA INC.	25703STLFW17THS
Chromium Compounds	TAMCO	91739TMC 12459
Chromium Compounds	TELEDYNE ALLVAC LATROBE PLANT	15650TLDYNROUTE
Chromium Compounds	TEXAS FOUNDRIES	75903TXSFN1611N
Chromium Compounds	TIMKEN CO. CANTON BEARING PLANT	44706THTMK1835D
Chromium Compounds	TIMKEN CO. FAIRCREST STEEL PLANT	44706THTMK4511F
Chromium Compounds	WASHINGTON STEEL CORP.	15342WSHNGWESTE
Formaldehyde	KEOKUK STEEL CASTINGS HAWKEYE DIV.	52632KKKST240RO
Lead Compounds	ALLEGHENY LUDLUM CORP.	15014LLGHNRIVER
Lead Compounds	AMERICAN CAST IRON PIPE CO.	35207MRCNC2930N
Lead Compounds	ARKANSAS STEEL ASSOC.	72112RKNSSVANDY
Lead Compounds	AUBURN STEEL CO. INC.	13021BRNSTQUARR
Lead Compounds	BAYOU STEEL CORP.	70069BYSTLRIVER
Lead Compounds	BETHLEHEM STEEL CORP. BAR ROD & WIRE DIV. (FRANKLIN)	15907FRNKL119WA
Lead Compounds	BETHLEHEM STEEL CORP. STEELTON PLANT	17113BTHLHFRONT
Lead Compounds	BIG THREE INDUSTRIAL GAS INC. SHARON ASP	16121SHRNSROEME
Lead Compounds	BIRMINGHAM STEEL CORP. BIRMINGHAM ALABAMA STEEL DIV.	35234BRMNG4301F
Lead Compounds	BIRMINGHAM STEEL CORP. JACKSON MISSISSIPPI STEEL DIV.	39208BSCSTFOURT
Lead Compounds	BIRMINGHAM STEEL CORP. KANKAKEE ILLINOIS STEEL DIV.	60914BRMNGRR1BO
Lead Compounds	CASCADE STEEL ROLLING MILLS INC.	97128CSCDS3200N

112(k) Source Category

Pollutant	Facility Name	TRI ID
Lead Compounds	CITISTEEL USA INC.	19703CTSTL4001P
Lead Compounds	CO-STEEL RARITAN	08862RRTNR225EL
Lead Compounds	COPPERWELD STEEL CO.	44482CPPRW4000M
Lead Compounds	EMPIRE-DETROIT STEEL DIV. DETROIT DIV.	44901MPRDT913BO
Lead Compounds	FIRSTMISS STEEL INC.	15935FRSTMRTE60
Lead Compounds	FLORIDA STEEL CORP.	28213FLRDSHWY11
Lead Compounds	FLORIDA STEEL CORP.	38305FLRDSUSHIG
Lead Compounds	FLORIDA STEEL CORP. JACKSONVILLE MILL DIV.	32234FLRDSHWY21
Lead Compounds	FLORIDA STEEL CORP. KNOXVILLE RF	37921FLRDS1919T
Lead Compounds	GEORGETOWN STEEL CORP.	29442GRGTWSOUTH
Lead Compounds	HOEGANAES CORP. AN INTERLAKE CO.	37066HGNSC810ST
Lead Compounds	INTERNATIONAL METALS RECLAMATION CO.	16117NTRNTSR488
Lead Compounds	J & L SPECIALTY STEEL INC.	15059JLSPC12THS
Lead Compounds	KENTUCKY ELECTRIC STEEL CORP.	41105KNTCKUS60W
Lead Compounds	KEYSTONE STEEL & WIRE CO.	61641KYSTN7000S
Lead Compounds	LACLEDE STEEL CO.	62002LCLDSCUTST
Lead Compounds	LONE STAR STEEL CO.	75668LNSTRHWY25
Lead Compounds	LUKENS STEEL CO.	19320LKNSSMODEN
Lead Compounds	MARATHON LETOURNEAU CO.	75601MRTHN2400S
Lead Compounds	NEWPORT STEEL CORP.	41071NWPRTLICKI
Lead Compounds	NORTH STAR STEEL CO. IOWA	52778NRTHSHWY38

112(k) Source Category

Pollutant	Facility Name	TRI ID
Lead Compounds	NORTH STAR STEEL CO. MICHIGAN	48161NRTHS3000E
Lead Compounds	NORTH STAR STEEL CO. MINNESOTA DIV.	55119NRTHS1678R
Lead Compounds	NORTH STAR STEEL OHIO	44510NRTHS2669W
Lead Compounds	NORTH STAR STEEL TEXAS	77701NRTHSOLDHI
Lead Compounds	NORTHWESTERN STEEL & WIRE CO.	61081NRTHW121WA
Lead Compounds	NUCOR STEEL	47933NCRST400SO
Lead Compounds	NUCOR STEEL	75846NCRSTHWY79
Lead Compounds	NUCOR STEEL UTAH DIV.	84330NCRST7285W
Lead Compounds	NUCOR-YAMATO STEEL CO.	72310NCRYMHWY18
Lead Compounds	OREGON STEEL MILLS INC.	97203RGNST14400
Lead Compounds	REPUBLIC ENGINEERED STEELS CANTON PLANT	44704LTVST26338
Lead Compounds	ROANOKE ELECTRIC STEEL CORP.	24017RNKLC102WE
Lead Compounds	SANDUSKY FOUNDRY & MACHINE CO.	44871SNDSK615WE
Lead Compounds	SHEFFIELD STEEL CORP.	74063SHFFL2300S
Lead Compounds	SMI STEEL INC.	35212SMSTLPOBOX
Lead Compounds	STRUCTURAL METALS INC.	78156STRCTPOBOX
Lead Compounds	TAMCO	91739TMC 12459
Lead Compounds	TIMKEN CO. FAIRCREST STEEL PLANT	44706THTMK4511F
Manganese Compounds	A. FINKL & SONS CO.	60614FNKLS2011S
Manganese Compounds	ABC RAIL PRODS. CORP.	35040BCRLC14THS
Manganese Compounds	AL TECH SPECIALTY STEEL CORP.	12189LTCHSSPRIN

112(k) Source Category

Pollutant	Facility Name	TRI ID
Manganese Compounds	ALLEGHENY LUDLUM CORP.	15014LLGHNRIVER
Manganese Compounds	AMERICAN CAST IRON PIPE CO.	35207MRCNC2930N
Manganese Compounds	ARKANSAS STEEL ASSOC.	72112RKNSSVANDY
Manganese Compounds	AUBURN STEEL CO. INC.	13021BRNSTQUARR
Manganese Compounds	BAYOU STEEL CORP.	70069BYSTLRIVER
Manganese Compounds	BETHLEHEM STEEL CORP. BAR ROD & WIRE DIV. (FRANKLIN)	15907FRNKL119WA
Manganese Compounds	BETHLEHEM STEEL CORP. STEELTON PLANT	17113BTHLHFRONT
Manganese Compounds	BIG THREE INDUSTRIAL GAS INC. SHARON ASP	16121SHRNSROEME
Manganese Compounds	BIRMINGHAM STEEL CORP. BIRMINGHAM ALABAMA STEEL DIV.	35234BRMNG4301F
Manganese Compounds	BIRMINGHAM STEEL CORP. JACKSON MISSISSIPPI STEEL DIV.	39208BSCSTFOURT
Manganese Compounds	BIRMINGHAM STEEL CORP. KANKAKEE ILLINOIS STEEL DIV.	60914BRMNGRR1BO
Manganese Compounds	BRIDGEVILLE STAINLESS & ALLOY PRODUCTS	15017CYTMPMAYER
Manganese Compounds	CARPENTER TECHNOLOGY CORP.	19612CRPNT101WB
Manganese Compounds	CITISTEEL USA INC.	19703CTSTL4001P
Manganese Compounds	CO-STEEL RARITAN	08862RRTNR225EL
Manganese Compounds	COPPERWELD STEEL CO.	44482CPPRW4000M
Manganese Compounds	CRUCIBLE SPECIALTY METALS SPECIALTY METALS DIV.	13209CRCBLSTATE
Manganese Compounds	EASTERN STAINLESS CORP.	21224STRNS7700R
Manganese Compounds	ELECTRALLOY CORP.	16301LCTRL175MA
Manganese Compounds	ELLWOOD UDDEHOLM STEEL CO.	16101LLWDD700MO
Manganese Compounds	EMPIRE-DETROIT STEEL DIV. DETROIT DIV.	44901MPRDT913BO

112(k) Source Category

Pollutant	Facility Name	TRI ID
Manganese Compounds	ESCO CORP.	39345SCCRPHIGHW
Manganese Compounds	ESCO CORP.	97210SCCRP2141N
Manganese Compounds	FIRSTMISS STEEL INC.	15935FRSTMRTE60
Manganese Compounds	FLORIDA STEEL CORP.	28213FLRDSHWY11
Manganese Compounds	FLORIDA STEEL CORP.	38305FLRDSUSHIG
Manganese Compounds	FLORIDA STEEL CORP. JACKSONVILLE MILL DIV.	32234FLRDSHWY21
Manganese Compounds	FLORIDA STEEL CORP. KNOXVILLE RF	37921FLRDS1919T
Manganese Compounds	GEORGETOWN STEEL CORP.	29442GRGTWSOUTH
Manganese Compounds	GREEN RIVER STEEL CORP.	42303GRNRV4701U
Manganese Compounds	HARRISON STEEL CASTINGS CO.	47918HRRSN900MO
Manganese Compounds	HAYNES INTERNATIONAL INC.	46902HYNSN1020W
Manganese Compounds	HOEGANAES CORP.	08077HGNSCRIVER
Manganese Compounds	INTERNATIONAL METALS RECLAMATION CO.	16117NTRNTSR488
Manganese Compounds	IPSCO STEEL INC.	52730PSCST18457
Manganese Compounds	IRI INTERNATIONAL CORP.	79066RNTRN5MILE
Manganese Compounds	J & L SPECIALTY STEEL INC.	15059JLSPC12THS
Manganese Compounds	KENTUCKY ELECTRIC STEEL CORP.	41105KNTCKUS60W
Manganese Compounds	KEOKUK STEEL CASTINGS HAWKEYE DIV.	52632KKKST240RO
Manganese Compounds	KEYSTONE STEEL & WIRE CO.	61641KYSTN7000S
Manganese Compounds	LACLEDE STEEL CO.	62002LCLDSCUTST
Manganese Compounds	LATROBE STEEL CO.	15650LTRBS2626L

112(k) Source Category

Pollutant	Facility Name	TRI ID
Manganese Compounds	LONE STAR STEEL CO.	75668LNSTRHWY25
Manganese Compounds	LUKENS STEEL CO.	19320LKNSSMODEN
Manganese Compounds	MARATHON LETOURNEAU CO.	75601MRTHN2400S
Manganese Compounds	MARION STEEL CO.	43302MRNST912CH
Manganese Compounds	MAYNARD STEEL CASTING CO.	53215MYNRD2856S
Manganese Compounds	NATIONAL FORGE CO.	16329NTNLF1FRON
Manganese Compounds	NEWPORT STEEL CORP.	41071NWPRTLICKI
Manganese Compounds	NORTH STAR STEEL CO. IOWA	52778NRTHSHWY38
Manganese Compounds	NORTH STAR STEEL CO. MICHIGAN	48161NRTHS3000E
Manganese Compounds	NORTH STAR STEEL CO. MINNESOTA DIV.	55119NRTHS1678R
Manganese Compounds	NORTH STAR STEEL OHIO	44510NRTHS2669W
Manganese Compounds	NORTH STAR STEEL TEXAS	77701NRTHSOLDHI
Manganese Compounds	NORTHWESTERN STEEL & WIRE CO.	61081NRTHW121WA
Manganese Compounds	NUCOR STEEL	47933NCRST400SO
Manganese Compounds	NUCOR STEEL	75846NCRSTHWY79
Manganese Compounds	NUCOR-YAMATO STEEL CO.	72310NCRYMHWY18
Manganese Compounds	OREGON STEEL MILLS INC.	97203RGNST14400
Manganese Compounds	REPUBLIC ENGINEERED STEELS CANTON PLANT	44704LTVST26338
Manganese Compounds	ROANOKE ELECTRIC STEEL CORP.	24017RNKLC102WE
Manganese Compounds	ROCKWELL INTERNATIONAL OHP&D DIV.	66002RCKWL4THAN
Manganese Compounds	SANDUSKY FOUNDRY & MACHINE CO.	44871SNDSK615WE

112(k) Source Category

Pollutant	Facility Name	TRI ID
Manganese Compounds	SHEFFIELD STEEL CORP.	74063SHFFL2300S
Manganese Compounds	SLATER STEELS FORT WAYNE SP ALLOYS DIV.	46801SLTRS2400T
Manganese Compounds	SMI STEEL INC.	35212SMSTLPOBOX
Manganese Compounds	STANDARD STEEL	15650STNDR107GE
Manganese Compounds	STANDARD STEEL	17009STNDR500WA
Manganese Compounds	STRUCTURAL METALS INC.	78156STRCTPOBOX
Manganese Compounds	SWVA INC.	25703STLFW17THS
Manganese Compounds	TAMCO	91739TMC 12459
Manganese Compounds	TIMKEN CO. FAIRCREST STEEL PLANT	44706THTMK4511F
Manganese Compounds	WASHINGTON STEEL CORP.	15342WSHNGWESTE
Methylene Chloride	BETHLEHEM STEEL CORP. BAR ROD & WIRE DIV. (FRANKLIN)	15907FRNKL119WA
Methylene Chloride	LONE STAR STEEL CO.	75668LNSTRHWY25
Methylene Diphenyl Diisocyanate	AMERICAN CAST IRON PIPE CO.	35207MRCNC2930N
Methylene Diphenyl Diisocyanate	ROCKWELL INTERNATIONAL OHP&D DIV.	66002RCKWL4THAN
Nickel Compounds	A. FINKL & SONS CO.	60614FNKLS2011S
Nickel Compounds	AL TECH SPECIALTY STEEL CORP.	12189LTCHSSPRIN
Nickel Compounds	ALLEGHENY LUDLUM CORP.	14094LLGHN695OH
Nickel Compounds	ALLEGHENY LUDLUM CORP.	15014LLGHNRIVER
Nickel Compounds	AMERICAN CAST IRON PIPE CO.	35207MRCNC2930N
Nickel Compounds	ARMCO INC. BUTLER OPS.	16001RMCDVBANTA
Nickel Compounds	BETHLEHEM STEEL CORP. BAR ROD & WIRE DIV. (FRANKLIN)	15907FRNKL119WA

112(k) Source Category

Pollutant	Facility Name	TRI ID
Nickel Compounds	BETHLEHEM STEEL CORP. STEELTON PLANT	17113BTHLHFRONT
Nickel Compounds	BIG THREE INDUSTRIAL GAS INC. SHARON ASP	16121SHRNSROEME
Nickel Compounds	BRIDGEVILLE STAINLESS & ALLOY PRODUCTS	15017CYTMPMAYER
Nickel Compounds	CARPENTER TECHNOLOGY CORP.	19612CRPNT101WB
Nickel Compounds	CASCADE STEEL ROLLING MILLS INC.	97128CSCDS3200N
Nickel Compounds	CITISTEEL USA INC.	19703CTSTL4001P
Nickel Compounds	COPPERWELD STEEL CO.	44482CPPRW4000M
Nickel Compounds	CRUCIBLE SPECIALTY METALS SPECIALTY METALS DIV.	13209CRCBLSTATE
Nickel Compounds	EASTERN STAINLESS CORP.	21224STRNS7700R
Nickel Compounds	ELECTRALLOY CORP.	16301LCTRL175MA
Nickel Compounds	ELLWOOD UDDEHOLM STEEL CO.	16101LLWDD700MO
Nickel Compounds	EMPIRE-DETROIT STEEL DIV. DETROIT DIV.	44901MPRDT913BO
Nickel Compounds	ESCO CORP.	39345SCCRPHIGHW
Nickel Compounds	ESCO CORP.	97210SCCRP2141N
Nickel Compounds	FIRSTMISS STEEL INC.	15935FRSTMRTE60
Nickel Compounds	FLORIDA STEEL CORP.	28213FLRDSHWY11
Nickel Compounds	FLORIDA STEEL CORP.	38305FLRDSUSHIG
Nickel Compounds	FLORIDA STEEL CORP. JACKSONVILLE MILL DIV.	32234FLRDSHWY21
Nickel Compounds	FLORIDA STEEL CORP. KNOXVILLE RF	37921FLRDS1919T
Nickel Compounds	GREEN RIVER STEEL CORP.	42303GRNRV4701U
Nickel Compounds	HARRISON STEEL CASTINGS CO.	47918HRRSN900MO

112(k) Source Category

Pollutant	Facility Name	TRI ID
Nickel Compounds	HAYNES INTERNATIONAL INC.	46902HYNSN1020W
Nickel Compounds	HOEGANAES CORP.	08077HGNSCRIVER
Nickel Compounds	HOEGANAES CORP. AN INTERLAKE CO.	37066HGNSC810ST
Nickel Compounds	INTERNATIONAL METALS RECLAMATION CO.	16117NTRNTSR488
Nickel Compounds	IPSCO STEEL INC.	52730PSCST18457
Nickel Compounds	IRI INTERNATIONAL CORP.	79066RNTRN5MILE
Nickel Compounds	J & L SPECIALTY STEEL INC.	15059JLSPC12THS
Nickel Compounds	KEOKUK STEEL CASTINGS HAWKEYE DIV.	52632KKKST240RO
Nickel Compounds	LACLEDE STEEL CO.	62002LCLDSCUTST
Nickel Compounds	LATROBE STEEL CO.	15650LTRBS2626L
Nickel Compounds	LUKENS STEEL CO.	19320LKNSSMODEN
Nickel Compounds	MARATHON LETOURNEAU CO.	75601MRTHN2400S
Nickel Compounds	MAYNARD STEEL CASTING CO.	53215MYNRD2856S
Nickel Compounds	NEWPORT STEEL CORP.	41071NWPRTLICKI
Nickel Compounds	NORTH STAR STEEL CO. IOWA	52778NRTHSHWY38
Nickel Compounds	NORTH STAR STEEL CO. MICHIGAN	48161NRTHS3000E
Nickel Compounds	NORTH STAR STEEL CO. MINNESOTA DIV.	55119NRTHS1678R
Nickel Compounds	NORTH STAR STEEL OHIO	44510NRTHS2669W
Nickel Compounds	NUCOR-YAMATO STEEL CO.	72310NCRYMHWY18
Nickel Compounds	OREGON STEEL MILLS INC.	97203RGNST14400
Nickel Compounds	REPUBLIC ENGINEERED STEELS CANTON PLANT	44704LTVST26338

112(k) Source Category

Pollutant	Facility Name	TRI ID
Nickel Compounds	ROANOKE ELECTRIC STEEL CORP.	24017RNKLC102WE
Nickel Compounds	ROCKWELL INTERNATIONAL OHP&D DIV.	66002RCKWL4THAN
Nickel Compounds	SANDUSKY FOUNDRY & MACHINE CO.	44871SNDSK615WE
Nickel Compounds	SHEFFIELD STEEL CORP.	74063SHFFL2300S
Nickel Compounds	SLATER STEELS FORT WAYNE SP ALLOYS DIV.	46801SLTRS2400T
Nickel Compounds	STANDARD STEEL	15650STNDR107GE
Nickel Compounds	STANDARD STEEL	17009STNDR500WA
Nickel Compounds	STRUCTURAL METALS INC.	78156STRCTPOBOX
Nickel Compounds	SWVA INC.	25703STLFW17THS
Nickel Compounds	TELEDYNE ALLVAC LATROBE PLANT	15650TLDYNROUTE
Nickel Compounds	TEXAS FOUNDRIES	75903TXSFN1611N
Nickel Compounds	TIMKEN CO. FAIRCREST STEEL PLANT	44706THTMK4511F
Nickel Compounds	WASHINGTON STEEL CORP.	15342WSHNGWESTE
Polycyclic Organic Matter as 16-PAH	ROCKWELL INTERNATIONAL OHP&D DIV.	66002RCKWL4THAN
Tetrachloroethylene	BIG THREE INDUSTRIAL GAS INC. SHARON ASP	16121SHRNSROEME
Tetrachloroethylene	CARPENTER TECHNOLOGY CORP.	19612CRPNT101WB
Trichloroethylene	NORTHWESTERN STEEL & WIRE CO.	61081NRTHW121WA
Trichloroethylene	SLATER STEELS FORT WAYNE SP ALLOYS DIV.	46801SLTRS2400T

Uranium Hexafluoride Production

1,3-Butadiene	KERR-MCGEE REFINING CORP.	73098KRRMC906SO
Benzene	KERR-MCGEE REFINING CORP.	73098KRRMC906SO

112(k) Source Category

Pollutant	Facility Name	TRI ID
Manganese Compounds	KERR-MCGEE REFINING CORP.	73098KRRMC906SO

Vegetable Oil Production

Pollutant	Facility Name	TRI ID
Ethylene Dichloride	VIOBIN CORP.	61856VBNCR226WE
Ethylene Oxide	ADM CORN PROCESSING	52732DMCRN1251B
Manganese Compounds	PERDUE FARMS INC.	21801PRDNCZIONC
Manganese Compounds	PERDUE FARMS INC. COFIELD FACILITY #12	27229PRDNCSTATE

Appendix C

1990 Toxic Release Inventory Data Extracted Based On SIC Code(s)

Appendix C includes source categories where SIC Codes were used to extract data from TRI, rather than selected facilities as was presented in Appendix B.[2] If pollutant-specific estimates from a facility in a particular SIC Code have already been accounted for in another source category, the estimates reported to TRI for that facility were removed. The list of facilities already accounted for appears in Appendix D.

The data in this appendix are organized first alphabetically by source category and then by SIC Code. A list of the Section 112(k) pollutants reported by facilities within the SIC Code is also presented. This appendix only includes estimates for Section 112(k) HAPs, not for any other TRI chemicals that were reported.

[2] U.S. Environmental Protection Agency. Toxic Release Inventory 1987-1995 CD ROM (1990 Data). EPA 749-C-97-003. Research Triangle Park, North Carolina. August 1997.

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112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Accident And Health Insurance		
Accident And Health Insurance	6321	
		Manganese Compounds
Adhesives and Sealants		
Adhesives And Sealants	2891	
		Acrylamide
		bis(2-Ethylhexyl)phthalate
		Chloroform
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dichloride
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Aerospace Industries		
Aircraft	3721	
		Benzene
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Aircraft Engines And Engine Parts	3724	
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Aircraft Parts And Equipment, Nec	3728	
		Benzene
		Chromium Compounds
		Ethylene Dichloride
		Formaldehyde
		Hydrazine
		Lead Compounds
		Manganese Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene

Agricultural Chemicals and Pesticides

SIC Code Description	SIC Code	Pollutant
Agricultural Chemicals, Nec	2879	
		1,2-Dichloropropane
		1,3-Butadiene
		1,3-Dichloropropene
		1,4-Dichlorobenzene
		Acrylonitrile
		Arsenic Compounds
		Benzene
		bis(2-Ethylhexyl)phthalate
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Lead Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Manganese Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
		Vinyl Chloride
Air and Gas Compressors		
Air And Gas Compressors	3563	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
Air Transportation, Scheduled		
Air Transportation, Scheduled	4512	
		Chromium Compounds
		Tetrachloroethylene
Aluminum Die-Castings		
Aluminum Die-castings	3363	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Aluminum Extruded Products		
Aluminum Extruded Products	3354	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Aluminum Foundries		
Aluminum Foundries	3365	
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
Aluminum Foundries (Castings)		
Aluminum Foundries (Castings)	3361	
		Beryllium Compounds
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
Aluminum Rolling and Drawing, nec		
Aluminum Rolling And Drawing, Nec	3355	
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Aluminum Sheet, Plate, and Foil manufacturing		
Aluminum Sheet, Plate, And Foil	3353	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Ammunition, Except for Small Arms		
Ammunition, Exc. For Small Arms, Nec	3483	
		Lead Compounds
		Trichloroethylene
Analytical Instruments		
Analytical Instruments	3826	
		Chromium Compounds
		Methylene Chloride
		Trichloroethylene
Apparel and Accessories, nec		
Apparel And Accessories, Nec	2389	
		Methylene Chloride
		Tetrachloroethylene
Architectural Metal Work		
Architectural Metal Work	3446	
		Methylene Chloride
		Trichloroethylene
Asbestos Products Manufacturing		
Asbestos Products	3292	
		Manganese Compounds
		Nickel Compounds
Asphalt Concrete Manufacturing		
Asphalt Paving Mixtures And Blocks	2951	
		Benzene
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Styrene
Asphalt Roofing Manufacturing		
Asphalt Felts And Coatings	2952	
		Benzene
		Chromium Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Formaldehyde
		Trichloroethylene
Automatic Vending Machines		
Automatic Vending Machines	3581	
		Methylene Chloride
		Trichloroethylene
Automotive Services, Nec		
Automotive Services, Nec	7549	
		Methylene Chloride
Automotive stampings		
Automotive Stampings	3465	
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Bags, Except Textile Bags		
Bags, except textile bags (disc. 1987, 2673 or 267)	2643	
		Tetrachloroethylene
Ball and Roller Bearings Manufacturing		
Ball And Roller Bearings	3562	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
Beet Sugar		
Beet Sugar	2063	
		Acetaldehyde
		Formaldehyde
Biological Products, Except Diagnostic		
Biological Products Exc. Diagnostic	2836	
		Methylene Chloride

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Blankbooks and Looseleaf Binders		
Blankbooks And Looseleaf Binders	2782	
		Trichloroethylene
Blast Furnaces and Steel Mills		
Blast Furnaces And Steel Mills	3312	
		Arsenic Compounds
		Benzene
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Quinoline
		Styrene
		Trichloroethylene
Blowers and Fans		
Blowers And Fans	3564	
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Trichloroethylene
Boat Manufacturing		
Boat Building And Repairing	3732	
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
Ship Building And Repairing	3731	
		Acrylonitrile
		Benzene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
Bolts, Nuts, Rivets and Washers Manufacturing		
Bolts, Nuts, Rivets, And Washers	3452	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Bottled and Canned Soft Drinks		
Bottled And Canned Soft Drinks	2086	
		Methylene Chloride
Brass, Bronze, Copper, Copper Base Alloy Foundries		
Brass, bronze, copper, copper base alloy foundries	3362	
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
Brooms and Brushes		
Brooms And Brushes	3991	
		Chromium Compounds
		Formaldehyde
		Trichloroethylene
Burial Caskets		
Burial Caskets	3995	
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
Business Services, nec (7399)		
Business Services, nec (7399)	7399	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Chloride
Buttons		
Buttons (disc. 1987, 3895)	3963	
		Styrene
Canned Fruits and Vegetables		
Canned Fruits And Vegetables	2033	
		Lead Compounds
Carbon and Graphite Products		
Carbon And Graphite Products	3624	
		Lead Compounds
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Carbon Black (not subject to MACT)		
Carbon Black	2895	
		Benzene
Carburetors, Pistons, Rings and Valves Manufacturing		
Carburetors, Pistons, Rings, Valves	3592	
		Benzene
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Cathode Ray Television Picture Tubes Manufacturing		
Printed Circuit Boards	3672	
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Tetrachloroethylene
		Trichloroethylene
Cement, Hydraulic (not subject to Portland Cement MACT)		
Cement, Hydraulic	3241	
		1,1,2,2-Tetrachloroethane
		1,1,2-Trichloroethane
		1,4-Dichlorobenzene
		Acrylonitrile
		Benzene
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethylene Dichloride
		Formaldehyde
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Certified Air Trans		
Certified Air Trans	4511	
		Methylene Chloride
		Tetrachloroethylene
Chemical Manufacturing: Alkalies and Chlorine (not subject to Chlorine Production MACT)		
Alkalies And Chlorine	2812	
		1,1,2,2-Tetrachloroethane
		1,1,2-Trichloroethane
		1,2-Dichloropropane
		1,3-Butadiene
		1,3-Dichloropropene
		Acetaldehyde
		Acrolein
		Acrylonitrile
		Benzene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Carbon Tetrachloride
		Chloroform
		Ethyl Acrylate
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Mercury Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
		Vinyl Chloride

Chemical Preparations

SIC Code Description	SIC Code	Pollutant
Chemical preparations, nec	2899	
		1,1,2,2-Tetrachloroethane
		1,1,2-Trichloroethane
		1,2-Dichloropropane
		1,3-Butadiene
		Acetaldehyde
		Acrolein
		Acrylamide
		Acrylonitrile
		Benzene
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Hydrazine
		Lead Compounds
		Manganese Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
		Vinylidene Chloride
Chemicals and Allied Products Manufacturing		
Chemicals And Allied Products	2800	
		1,1,2,2-Tetrachloroethane
		1,1,2-Trichloroethane
		Benzene
		bis(2-Ethylhexyl)phthalate
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Lead Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Chemicals and allied products (disc. 1987, 5162 or)	5161	
		1,4-Dichlorobenzene
		Ethylene Dichloride
		Formaldehyde
		Methylene Chloride

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Chemicals and Allied Products, nec		
Chemicals & Allied Products, Nec	5169	
		Acetaldehyde
		Benzene
		Carbon Tetrachloride
		Chloroform
		Ethyl Acrylate
		Formaldehyde
		Methylene Chloride
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Clay Products Manufacturing		
Brick And Structural Clay Tile	3251	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
Ceramic Wall And Floor Tile	3253	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
Minerals, Ground Or Treated	3295	
		1,1,2,2-Tetrachloroethane
		1,1,2-Trichloroethane
		Benzene
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Formaldehyde
		Lead Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Chloride
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Porcelain Electrical Supplies	3264	
		Arsenic Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Pottery Products, Nec	3269	
		Chromium Compounds
		Lead Compounds
		Nickel Compounds
		Styrene
Semivitreous Table & Kitchenware	3263	
		Lead Compounds
Vitreous China Table & Kitchenware	3262	
		Lead Compounds
Vitreous Plumbing Fixtures	3261	
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
		Trichloroethylene

Clay Refractories (not subject to Refractories Manufacturing MACT)

SIC Code Description	SIC Code	Pollutant
Clay Refractories	3255	
		Chromium Compounds
		Manganese Compounds
		Polycyclic Organic Matter as 16-PAH

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Cold Finishing of Steel Shapes		
Cold Finishing Of Steel Shapes	3316	
		Arsenic Compounds
		Benzene
		Beryllium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Commercial Laundry Equipment		
Commercial Laundry Equipment	3582	
		Trichloroethylene
Commercial Lighting Fixtures		
Commercial Lighting Fixtures	3646	
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Commercial Physical Research		
Commercial Physical Research	8731	
		1,3-Butadiene
		Benzene
		Chromium Compounds
		Ethylene Dibromide
		Ethylene Dichloride
		Formaldehyde
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
Commercial Printing, Letterpress, and Screen		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Commercial printing, letterpress, and screen (disc)	2751	
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
Commercial Printing, Lithographic		
Commercial Printing, Lithographic	2752	
		bis(2-Ethylhexyl)phthalate
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Communications Equipment, nec		
Communications Equipment, Nec	3669	
		Lead Compounds
		Methylene Chloride
		Tetrachloroethylene
Computer Terminals		
Computer Terminals	3575	
		Trichloroethylene
Concrete Block and Brick		
Concrete Block And Brick	3271	
		Manganese Compounds
		Methylene Chloride
		Styrene
		Trichloroethylene
Concrete Products		
Concrete Products, Nec	3272	
		bis(2-Ethylhexyl)phthalate
		Manganese Compounds
		Methylene Chloride
		Styrene
Condensed and Evaporated milk		
Dry, Condensed, Evaporated Products	2023	
		Benzene
Construction Machinery Manufacturing		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Construction Machinery	3531	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene

Conveyors and Conveying Equipment Manufacturing

SIC Code Description	SIC Code	Pollutant
Conveyors And Conveying Equipment	3535	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds

Copper Foundries

SIC Code Description	SIC Code	Pollutant
Copper Foundries	3366	
		Lead Compounds
		Manganese Compounds
		Nickel Compounds

Copper Rolling and Drawing

SIC Code Description	SIC Code	Pollutant
Copper Rolling And Drawing	3351	
		Beryllium Compounds
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene

Creamery Butter

SIC Code Description	SIC Code	Pollutant
Creamery Butter	2021	
		Styrene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Crowns & Closures		
Crowns & Closures	3468	
		bis(2-Ethylhexyl)phthalate
Crushed And Broken Limestone		
Crushed And Broken Limestone	1422	
		Manganese Compounds
Custom Compound Purchased Resins Manufacturing		
Custom Compound Purchased Resins	3087	
		Arsenic Compounds
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Styrene
Cut Stone and Stone Products		
Cut Stone And Stone Products	3281	
		Styrene
Cutlery		
Cutlery	3421	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Cyclic Crude and Intermediate Production (not subject to Petroleum Refining MACT)		
Cyclic Crudes And Intermediates	2865	
		1,1,2,2-Tetrachloroethane
		1,1,2-Trichloroethane

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		1,3-Butadiene
		Acetaldehyde
		Acrolein
		Acrylamide
		Acrylonitrile
		Benzene
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dibromide
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Lead Compounds
		Manganese Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Quinoline
		Styrene
		Tetrachloroethylene
		Trichloroethylene
		Vinyl Chloride
		Vinylidene Chloride
Dental Equipment and Supplies		
Dental Equipment And Supplies	3843	
		Trichloroethylene
Distilled and Blended Liquors Production		
Distilled And Blended Liquors	2085	
		Acetaldehyde

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Benzene
		Ethylene Oxide
Dog and Cat Food		
Dog And Cat Food	2047	
		Lead Compounds
		Manganese Compounds
Drapery Hardware and Blinds and Shades		
Drapery Hardware & Blinds & Shades	2591	
		Formaldehyde
Edible Fats and Oils, nec		
Edible Fats And Oils, Nec	2079	
		Nickel Compounds
Electric Lamps		
Electric Lamps	3641	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methylene Chloride
		Trichloroethylene
Electrical Apparatus and Equipment		
Electrical Apparatus And Equipment	5063	
		Chromium Compounds
		Nickel Compounds
		Trichloroethylene
Electrical Equipment and Supplies, nec		
Electrical Equipment & Supplies, Nec	3699	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Electrical Housewares and Fans		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Electric Housewares And Fans	3634	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Electrical Industrial Apparatus, nec		
Electrical Industrial Apparatus, Nec	3629	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Nickel Compounds
		Trichloroethylene
Electromedical Equipment Manufacturing		
Electromedical Equipment	3845	
		Ethylene Oxide
		Methylene Chloride
Electrometallurgical Products Manufacturing		
Electrometallurgical Products	3313	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
Electron Tubes Manufacturing		
Electron Tubes	3671	
		Lead Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Electronic Capacitors Manufacturing		
Electronic Capacitors	3675	
		bis(2-Ethylhexyl)phthalate
		Lead Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Manganese Compounds
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Electronic Coils and Transformers		
Electronic Coils And Transformers	3677	
		Manganese Compounds
		Methylene Chloride
Electronic Components and Accessories		
Electronic Components And Accessories	3670	
		bis(2-Ethylhexyl)phthalate
		Methylene Chloride
		Trichloroethylene
Electronic Components, nec		
Electronic Components, Nec	3679	
		Beryllium Compounds
		Chromium Compounds
		Ethylene Oxide
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Electronic Connectors		
Electronic Connectors	3678	
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Electronic Resistors		
Electronic Resistors	3676	
		Lead Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Chloride
		Trichloroethylene
Elevators and Moving Stairways Manufacturing		
Elevators And Moving Stairways	3534	
		Lead Compounds
		Styrene
		Trichloroethylene
Engine Electric Equipment		
Engine Electrical Equipment	3694	
		Benzene
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Engineering, Laboratory, Scientific and Research		
Engineering, Laboratory, Scientific and Research	3811	
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Trichloroethylene
Environmental Controls Manufacturing		
Environmental Controls	3822	
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Fabric Dress and Work Gloves		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Fabric Dress And Work Gloves	2381	
		bis(2-Ethylhexyl)phthalate
		Carbon Tetrachloride
		Polycyclic Organic Matter as 16-PAH
Fabricated Metal Products Manufacturing		
Fabricated Metal Products	3400	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
Fabricated Metal Products, nec		
Fabricated Metal Products, Nec	3499	
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Chromium Compounds
		Ethylene Dichloride
		Lead Compounds
		Manganese Compounds
		Methyl Chloride
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Fabricated Pipe and Fittings		
Fabricated Pipe And Fittings	3498	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Fabricated Plate Work (Boiler Shops)		
Fabricated Plate Work (boiler Shops)	3443	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Fabricated Rubber Products Manufacturing		
Fabricated Rubber Products, Nec	3060	
		Methylene Diphenyl Diisocyanate
Fabricated Rubber Products, nec		
Fabricated Rubber Products, Nec	3069	
		Acrylonitrile
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Fabricated Structural Metal Manufacturing		
Fabricated Structural Metal	3441	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Tetrachloroethylene
Fabricated Structural Metal Products		
Fabricated Structural Metal Products	3440	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
Fabricated Textile Products, nec		
Fabricated Textile Products, Nec	2399	
		Formaldehyde
		Tetrachloroethylene
Farm Machinery and Equipment Manufacturing		
Farm Machinery And Equipment	3523	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
Fasteners, Buttons, Needles, and Pins		
Fasteners, Buttons, Needles, & Pins	3965	
		Methylene Chloride
		Nickel Compounds
		Styrene
Fertilizers, Mixing only		
Fertilizers, Mixing Only	2875	
		Formaldehyde
		Lead Compounds
		Manganese Compounds
Fiber Cans, Drums, and Similar Products		
Fiber Cans, Drums & Similar Products	2655	
		Polycyclic Organic Matter as 16-PAH
		Trichloroethylene
Flat Glass		
Flat Glass	3211	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Chloride
		Tetrachloroethylene
Flavoring Extracts and Syrups Production		
Flavoring Extracts And Syrups, Nec	2087	
		Acetaldehyde
		Methylene Chloride
Fluid Meters and Counting Devices		
Fluid Meters And Counting Devices	3824	
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Fluid Power Cylinders and Activators		
Fluid Power Cylinders & Actuators	3593	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
Fluid Power Pumps and Motors		
Fluid Power Pumps And Motors	3594	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Fluid Power Valves and Hose Fittings Manufacturing		
Fluid Power Valves & Hose Fittings	3492	
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Food Preparations Production		
Food Preparations, Nec	2099	
		Acetaldehyde

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chloroform
		Formaldehyde
		Lead Compounds
		Methylene Chloride
Food Products Machinery		
Food products machinery (disc. 1987, 3556)	3551	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Food Products Machinery Manufacturing		
Food Products Machinery	3556	
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Trichloroethylene
Footwear Cut Stock		
Footwear Cut Stock	3131	
		Formaldehyde
		Methylene Chloride
Footwear, Except Rubber, nec		
Footwear, Except Rubber, Nec	3149	
		Methylene Chloride
Gaskets, Packing and Sealing Devices		
Gaskets, Packing And Sealing Devices	3293	
		Methylene Chloride
		Trichloroethylene
Gaskets, Packing and Sealing Devices Manufacturing		
Gaskets, Packing And Sealing Devices	3053	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Methylene Chloride
		Nickel Compounds
General building contractors		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
General building contractors	1510	
		Styrene
General Industrial Machinery Manufacturing		
General Industrial Machinery, Nec	3569	
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
Glass Containers		
Glass Containers	3221	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
Guided Missiles and Space Vehicles Manufacturing		
Guided Missiles And Space Vehicles	3761	
		Chromium Compounds
		Hydrazine
		Methylene Chloride
		Nickel Compounds
Gum and Wood Chemical Manufacturing		
Gum And Wood Chemicals	2861	
		1,2-Dichloropropane
		Ethylene Oxide
		Formaldehyde
		Polycyclic Organic Matter as 16-PAH
		Styrene
Hand and Edge Tools Manufacturing		
Hand And Edge Tools, Nec	3423	
		Benzene
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Hardware Manufacturing		
Hardware, Nec	3429	
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Hardwood Veneer and Plywood		
Hardwood Veneer And Plywood	2435	
		Formaldehyde
Heating Equipment, Except Electric		
Heating Equipment, Except Electric	3433	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
Heavy Construction, Nec		
Heavy Construction, Nec	1629	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
Highway And Street Construction		
Highway And Street Construction	1611	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Benzene
Hoists, Cranes, and Monorails		
Hoists, Cranes, And Monorails	3536	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
Hose and Belting and Gaskets and Packing		
Hose & Belting & Gaskets & Packing	3050	
		Methylene Chloride
House Slippers		
House Slippers	3142	
		bis(2-Ethylhexyl)phthalate
Household Appliances		
Household Appliances	3630	
		Styrene
		Tetrachloroethylene
Household Audio and Video Equipment		
Household Audio And Video Equipment	3651	
		Formaldehyde
		Lead Compounds
		Styrene
		Trichloroethylene
Household Vacuum Cleaners		
Household Vacuum Cleaners	3635	
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Industrial Controls		
Industrial controls (disc. 1987, 3625)	3622	
		Methylene Chloride
		Trichloroethylene
Industrial Furnaces and Ovens		
Industrial Furnaces And Ovens	3567	
		Chromium Compounds
		Manganese Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Nickel Compounds
		Trichloroethylene
Industrial Gases Manufacturing		
Industrial Gases	2813	
		1,3-Butadiene
		Acrylonitrile
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Methyl Chloride
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
		Vinyl Chloride
Industrial Inorganic Chemical Manufacturing		
Industrial Inorganic Chemicals, Nec	2819	
		1,3-Butadiene
		1,3-Dichloropropene
		Acetaldehyde
		Acrolein
		Acrylamide
		Acrylonitrile
		Arsenic Compounds
		Benzene
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dibromide
		Ethylene Dichloride

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Industrial Machinery, nec		
Industrial Machinery, Nec	3599	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Industrial Organic Chemicals		
Industrial Organic Chemicals	2860	
		Acrylonitrile
Industrial Organic Chemicals Manufacturing		
Industrial Organic Chemicals, Nec	2869	
		1,1,2,2-Tetrachloroethane
		1,1,2-Trichloroethane
		1,2-Dichloropropane
		1,3-Butadiene
		1,3-Dichloropropene
		1,4-Dichlorobenzene
		Acetaldehyde

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Acrolein
		Acrylamide
		Acrylonitrile
		Arsenic Compounds
		Benzene
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dibromide
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
		Vinyl Chloride
		Vinylidene Chloride
Industrial Patterns		
Industrial Patterns	3543	
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Styrene
Industrial Patterns Packaging machinery		
Packaging Machinery	3565	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
Inorganic Pigments Manufacturing		
Inorganic Pigments	2816	
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
		Tetrachloroethylene
Instruments to Measure Electricity		
Instruments To Measure Electricity	3825	
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Internal Combustion Engine Manufacturing		
Internal Combustion Engines, Nec	3519	
		Benzene
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Trichloroethylene
Iron and Steel Forging		
Iron And Steel Forgings	3462	
		Chromium Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Iron and Steel Foundries (not subject to Iron Foundries MACT)		
Iron And Steel Foundries	3320	
		Chromium Compounds
Iron Foundries		
Gray And Ductile Iron Foundries	3321	
		Arsenic Compounds
		Benzene
		Cadmium Compounds
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Trichloroethylene
Malleable Iron Foundries	3322	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
Jewelry, Precious Metal		
Jewelry, Precious Metal	3911	
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Large Appliance (Surface Coating)		
Household Appliances, Nec	3639	
		Chromium Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Trichloroethylene
Household Cooking Equipment	3631	
		Beryllium Compounds
		Cadmium Compounds
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Household Laundry Equipment	3633	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
Household Refrigerators And Freezers	3632	
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Styrene
		Tetrachloroethylene
Refrigeration And Heating Equipment	3585	
		Benzene
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Service Industry Machinery, Nec	3589	
		Chromium Compounds
		Manganese Compounds
		Tetrachloroethylene
Lawn and Garden Equipment		
Lawn And Garden Equipment	3524	
		Formaldehyde
		Manganese Compounds
		Nickel Compounds
		Styrene
		Tetrachloroethylene
Lead Pencils, Art Goods Manufacturing		
Lead Pencils And Art Goods	3952	
		Arsenic Compounds
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
Leather Goods, nec		
Leather Goods, Nec	3199	
		Methylene Chloride
		Tetrachloroethylene
Lighting Equipment		
Lighting Equipment, Nec	3648	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Trichloroethylene
Lime Manufacturing		
Lime	3274	
		Chromium Compounds
		Lead Compounds
Lubricating Oils and Greases		
Lubricating Oils And Greases	2992	
		Benzene
		Lead Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Luggage		
Luggage	3161	
		Methylene Chloride
Machine Tool Accessories		
Machine Tool Accessories	3545	
		Chromium Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Machine tools, Metal Cutting Types		
Machine Tools, Metal Cutting Types	3541	
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Machine tools, Metal Forming Types		
Machine Tools, Metal Forming Types	3542	
		Manganese Compounds
		Nickel Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Tetrachloroethylene
		Trichloroethylene
Magnetic and Optical Recording Media Manufacturing		
Magnetic And Optical Recording Media	3695	
		Chromium Compounds
		Nickel Compounds
Malt Beverages		
Malt Beverages	2082	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
Manifold Business Forms		
Manifold Business Forms	2761	
		Chromium Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
Manufacturing Industries, nec		
Manufacturing Industries, Nec	3999	
		Benzene
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Marking Devices		
Marking Devices	3953	
		Tetrachloroethylene
Measuring and Controlling Devices, nec		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Measuring & Controlling Devices, Nec	3829	
		Chromium Compounds
		Lead Compounds
		Trichloroethylene
Measuring and Dispensing Pumps		
Measuring And Dispensing Pumps	3586	
		Tetrachloroethylene
Meat Packing Plants		
Meat Packing Plants	2011	
		1,1,2-Trichloroethane
		1,3-Butadiene
		Benzene
		Chromium Compounds
		Lead Compounds
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
Mechanical Rubber Goods Manufacturing		
Mechanical Rubber Goods	3061	
		bis(2-Ethylhexyl)phthalate
		Tetrachloroethylene
		Trichloroethylene
Men's and Boys' Shirts		
Men's And Boys' Shirts	2321	
		Methylene Chloride
Men's And Boys' Suits And Coats		
Men's And Boys' Suits And Coats	2311	
		Nickel Compounds
Men's And Boys' Trousers And Slacks		
Men's And Boys' Trousers And Slacks	2325	
		Manganese Compounds
Men's and Boys' Work Clothing		
Men's And Boys' Work Clothing	2326	
		Manganese Compounds
Men's Footwear, Except Athletic		
Men's Footwear, Except Athletic	3143	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Chloride
Metal Barrels, Drums, and Pails Manufacturing		
Metal Barrels, Drums, And Pails	3412	
		Acrylamide
		Acrylonitrile
		Chromium Compounds
		Ethyl Acrylate
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Trichloroethylene
Metal Can (Surface Coating)		
Crowns And Closures	3466	
		bis(2-Ethylhexyl)phthalate
Metal Cans	3411	
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Metal Cans and Shipping Containers		
Metal Cans And Shipping Containers	3410	
		Manganese Compounds
Metal coating and allied services (3479)		
Metal coating and allied services	3479	
		Carbon Tetrachloride
		Chromium Compounds
		Formaldehyde
		Lead Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Metal Doors, Sash, and Trim		
Metal Doors, Sash, And Trim	3442	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Trichloroethylene
Metal Forgings and Stampings		
Metal Forgings And Stampings	3460	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Metal Furniture (Surface Coating)		
Metal Household Furniture	2514	
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
Office Furniture, Except Wood	2522	
		Benzene
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Tetrachloroethylene
		Trichloroethylene
Partitions And Fixtures, Except Wood	2542	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Trichloroethylene
Public Building & Related Furniture	2531	
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Trichloroethylene
Metal Heat Treating Manufacturing		
Metal Heat Treating	3398	
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Metal Sanitary Ware Manufacturing		
Metal Sanitary Ware	3431	
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Metal Services, nec		
Coating, Engraving, & Allied Services (1987)	3470	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chromium Compounds
		Formaldehyde
		Methylene Chloride
		Nickel Compounds
		Trichloroethylene
Metal Stampings Manufacturing		
Metal Stampings, Nec	3469	
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Metal Valves		
Industrial Valves	3491	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
Metals Service Centers and Offices		
Metals Service Centers And Offices	5051	
		Tetrachloroethylene
Metalworking Machinery		
Metalworking Machinery	3540	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Metalworking Machinery, nec		
Metalworking Machinery, Nec	3549	
		Tetrachloroethylene
Millwork, Plywood, and Structural Members		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Millwork, Plywood & Structural Members	2430	
		Formaldehyde
Mineral Wool Manufacturing (not subject to Mineral Wool Production MACT)		
Mineral Wool	3296	
		Chromium Compounds
		Formaldehyde
		Methylene Diphenyl Diisocyanate
		Styrene
Mining Machinery Manufacturing		
Mining Machinery	3532	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
Misc. Nonmetallic Mineral Products		
Misc. Nonmetallic Mineral Products	3290	
		Formaldehyde
Miscellaneous Chemical Products (2890)		
Miscellaneous Chemical Products	2890	
		Methylene Diphenyl Diisocyanate
		Polycyclic Organic Matter as 16-PAH
Miscellaneous Fabricated Metal Products		
Misc. Fabricated Metal Products	3490	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Miscellaneous Fabricated Wire Products		
Misc. Fabricated Wire Products	3496	
		Chromium Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Miscellaneous Manufactures (3990)		
Miscellaneous Manufactures	3990	
		Nickel Compounds
		Trichloroethylene
Miscellaneous Metal Work		
Miscellaneous Metal Work	3449	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Miscellaneous Plastics Products		
Miscellaneous plastics products (disc. 1987, 3081,	3079	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Miscellaneous Plastics Products, nec		
Miscellaneous Plastics Products, Nec	3080	
		Styrene
Miscellaneous Publishing		
Miscellaneous Publishing	2741	
		Tetrachloroethylene
Miscellaneous Transportation Equipment		
Miscellaneous Transportation Equipment	3790	
		Styrene
MON		
Explosives	2892	
		Lead Compounds
Motor and Generators Manufacturing		
Motor and Generators Manufacturing	3621	
		1,3-Butadiene
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Motor Vehicle Equipment		
Motor Vehicles And Equipment	3710	
		Benzene
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
National Security		
National Security	9711	
		Methylene Chloride
		Trichloroethylene
Needles, Pins, Hooks and Eyes and Similar Notions		
Needles, pins, hooks and eyes and similar notions	3964	
		Polycyclic Organic Matter as 16-PAH
		Trichloroethylene
Nitrogenous Fertilizers		
Nitrogenous Fertilizers	2873	
		Acrylonitrile
		Chromium Compounds
		Formaldehyde
		Nickel Compounds
Non-Vehicular IC Engines		
Engines And Turbines	3510	
		Tetrachloroethylene
Nonclay Refractories (not subject to Refractories Manufacturing MACT)		
Nonclay Refractories	3297	
		Chromium Compounds
		Nickel Compounds
Noncurrent-Carrying Wiring Devices		
Noncurrent-carrying Wiring Devices	3644	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Nonferrous Die-castings, Except Aluminum		
Nonferrous Die-casting Exc. Aluminum	3364	
		Chromium Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Nonferrous Forgings		
Nonferrous Forgings	3463	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Styrene
		Trichloroethylene
Nonferrous Foundries, nec		
Nonferrous Foundries, Nec	3369	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Nonferrous Rolling and Drawing		
Nonferrous Rolling And Drawing, Nec	3356	
		Cadmium Compounds
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Nonferrous Wire Drawing and Insulating		
Nonferrous Wire Drawing and Insulating	3357	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Arsenic Compounds
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Carbon Tetrachloride
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Nonmetallic Mineral Products Manufacturing		
Nonmetallic Mineral Products, Nec	3299	
		Benzene
		bis(2-Ethylhexyl)phthalate
		Chloroform
		Lead Compounds
		Mercury Compounds
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Oil and Gas Field Machinery Manufacturing		
Oil And Gas Field Machinery	3533	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
Ophthalmic Goods		
Ophthalmic Goods	3851	
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Optical Instruments and Lenses		
Optical Instruments And Lenses	3827	
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Trichloroethylene
Optical instruments and lenses (disc. 1987, 3827)		
Optical instruments and lenses (disc. 1987, 3827)	3832	
		Methylene Chloride
Ordnance and Accessories Manufacturing		
Ordnance And Accessories, Nec	3489	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Ordnance And Accessories, nec		
Ordnance And Accessories, Nec	3480	
		Methylene Chloride
Paints and Allied Products Manufacturing		
Paints And Allied Products	2851	
		1,1,2-Trichloroethane
		Acrylamide
		Acrylonitrile
		Benzene
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Carbon Tetrachloride
		Chromium Compounds
		Ethyl Acrylate
		Formaldehyde
		Lead Compounds
		Manganese Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Mercury Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Paper And Allied Products		
Paper And Allied Products	2600	
		Chloroform
Paper and Other Webs (Surface Coating)		
Abrasive Products	3291	
		1,4-Dichlorobenzene
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
Converted Paper Products, Nec	2679	
		bis(2-Ethylhexyl)phthalate
		Formaldehyde
		Tetrachloroethylene
Corrugated And Solid Fiber Boxes	2653	
		Methylene Diphenyl Diisocyanate
Envelopes	2677	
		Tetrachloroethylene
Folding Paperboard Boxes, Including Sanitary	2657	
		Benzene
		Methylene Chloride

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Tetrachloroethylene
		Trichloroethylene
Laminated Plastics Plate & Sheet	3083	
		Formaldehyde
Paper Coated And Laminated, Nec	2672	
		Acrylamide
		Benzene
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
Paper Coating and Glazing Manufacturing		
Paper coating and glazing (disc. 1987, 2671 or 267)	2641	
		Benzene
		bis(2-Ethylhexyl)phthalate
		Formaldehyde
		Styrene
		Tetrachloroethylene
Paper Industries Machinery		
Paper Industries Machinery	3554	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
Paper Mills (not subject to Pulp and Paper MACT)		
Paper Mills	2621	
		Chloroform
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Styrene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Paperboard Mills		
Paperboard Mills	2631	
		Chloroform
		Chromium Compounds
		Styrene
Particleboard		
Particleboard (disc. 1987, 2493)	2492	
		Formaldehyde
Partitions And Fixtures		
Partitions And Fixtures	2540	
		Formaldehyde
Pens and Mechanical Pencils		
Pens And Mechanical Pencils	3951	
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Petroleum Bulk Stations and Terminals (not subject to Petroleum Refining MACT)		
Petroleum Bulk Stations & Terminals	5171	
		1,1,2-Trichloroethane
		Benzene
		Lead Compounds
		Polycyclic Organic Matter as 16-PAH
Petroleum Products, nec		
Petroleum Products, Nec	5172	
		Methylene Chloride
Petroleum Refining (not subject to Petroleum Refining MACT)		
Petroleum And Coal Products, Nec	2999	
		Benzene
		Methylene Chloride
		Trichloroethylene
Petroleum Refining	2911	
		1,2-Dichloropropane
		1,3-Butadiene
		Arsenic Compounds
		Benzene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Carbon Tetrachloride
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dibromide
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methyl Chloride
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Pharmaceuticals Production		
Biological Products	2831	
		Carbon Tetrachloride
		Chloroform
		Methylene Chloride
Drugs	2830	
		1,1,2-Trichloroethane
		Chloroform
		Methylene Chloride
Medicinals And Botanicals	2833	
		Arsenic Compounds
		Ethyl Acrylate
		Manganese Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
Pharmaceutical Preparations	2834	
		Acrylonitrile
		Arsenic Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		bis(2-Ethylhexyl)phthalate
		Carbon Tetrachloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Quinoline
		Tetrachloroethylene
		Vinylidene Chloride
Phosphate Fertilizers Production		
Phosphatic Fertilizers	2874	
		Lead Compounds
		Manganese Compounds
Photographic Equipment And Supplies		
Photographic Equipment And Supplies	3861	
		1,1,2-Trichloroethane
		1,2-Dichloropropane
		Acetaldehyde
		Acrylonitrile
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dichloride
		Formaldehyde
		Methylene Chloride
		Styrene
		Trichloroethylene
		Vinylidene Chloride
Plastic Parts and Products (Surface Coating)		
Computer Peripheral Equipment, Nec	3577	
		Formaldehyde
		Lead Compounds
		Methylene Diphenyl Diisocyanate
Costume Jewelry	3961	
		Lead Compounds
		Trichloroethylene
Current-carrying Wiring Devices	3643	
		Chloroform

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Electronic Computers	3571	
		Lead Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
Electronic computing equipment (disc. 1987, 3571...)	3573	
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Trichloroethylene
Games, Toys, And Children's Vehicles	3944	
		Methylene Chloride
		Trichloroethylene
Industrial Trucks And Tractors	3537	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Motor Homes	3716	
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
Motor Vehicle Parts And Accessories	3714	
		Benzene
		bis(2-Ethylhexyl)phthalate
		Chloroform
		Chromium Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Ethylene Dibromide
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
		Vinyl Chloride
Motor Vehicles And Car Bodies	3711	
		Benzene
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
Motorcycles, Bicycles, And Parts	3751	
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
Musical Instruments	3931	
		Lead Compounds
		Trichloroethylene
Office Machines, Nec	3579	
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Plastics Foam Products	3086	
		Acrylonitrile
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Chromium Compounds
		Ethylene Dichloride
		Formaldehyde
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
Plastics Products, Nec	3089	
		Arsenic Compounds
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Oxide
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Signs And Advertising Specialities	3993	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Sporting And Athletic Goods, Nec	3949	
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Trichloroethylene
Transportation Equipment, Nec	3799	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
Truck And Bus Bodies	3713	
		Benzene
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
Truck Trailers	3715	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Trichloroethylene
Vehicular Lighting Equipment	3647	
		Lead Compounds
		Methylene Chloride
		Tetrachloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Trichloroethylene
Plastics Pipe		
Plastics Pipe	3084	
		Methylene Chloride
Plastics Products Inc. Plastic Bottles		
Plastics Bottles	3085	
		bis(2-Ethylhexyl)phthalate
		Nickel Compounds
Platemaking Services		
Platemaking Services	2796	
		Tetrachloroethylene
Plating And Polishing		
Plating And Polishing	3471	
		Arsenic Compounds
		Cadmium Compounds
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Plumbing And Heating, Except Electric		
Plumbing And Heating, Except Electric	3430	
		Chromium Compounds
		Nickel Compounds
Plumbing Fixture Fittings and Trim		
Plumbing Fixture Fittings And Trim	3432	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Tetrachloroethylene
		Trichloroethylene
Plumbing, Heating, Air-conditioning		
Plumbing, Heating, Air-conditioning	1710	
		Trichloroethylene
Polishes and Sanitation Goods Manufacturing		
Polishes And Sanitation Goods	2842	
		1,4-Dichlorobenzene
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methyl Chloride
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Polymers & Resins (I, II, and IV)		
Cellulosic Manmade Fibers	2823	
		Benzene
		Ethyl Acrylate
		Formaldehyde
		Methylene Chloride
Organic Fibers, Noncellulosic	2824	
		Acetaldehyde
		Acrylonitrile
		Benzene
		bis(2-Ethylhexyl)phthalate
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Tetrachloroethylene
		Vinylidene Chloride
Plastics Materials And Resins	2821	
		1,1,2,2-Tetrachloroethane
		1,2-Dichloropropane
		1,3-Butadiene
		1,3-Dichloropropene
		Acetaldehyde
		Acrolein
		Acrylamide
		Acrylonitrile
		Benzene
		bis(2-Ethylhexyl)phthalate
		Chloroform
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methyl Chloride
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
		Vinyl Chloride
		Vinylidene Chloride
Synthetic Rubber	2822	
		1,3-Butadiene
		Acrylamide

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Acrylonitrile
		Benzene
		bis(2-Ethylhexyl)phthalate
		Carbon Tetrachloride
		Chloroform
		Ethyl Acrylate
		Ethylene Dibromide
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Hydrazine
		Methylene Chloride
		Nickel Compounds
		Styrene
		Vinylidene Chloride
Potato Chips and Similar Snacks		
Potato Chips And Similar Snacks	2096	
		Benzene
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
Poultry Slaughtering and Processing		
Poultry Slaughtering And Processing	2015	
		Formaldehyde
Power Driven Handtools		
Power-driven Handtools	3546	
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Nickel Compounds
		Trichloroethylene
Power Transmission Equipment		
Power Transmission Equipment, Nec	3568	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
Prefabricated Metal Buildings		
Prefabricated Metal Buildings	3448	
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Styrene
		Trichloroethylene
Prepared Feeds Manufacturing		
Prepared Feeds, Nec	2048	
		Arsenic Compounds
		Chromium Compounds
		Ethylene Oxide
		Manganese Compounds
Pressed and Blown Glass and Glassware Manufacturing		
Pressed And Blown Glass, Nec	3229	
		Arsenic Compounds
		Cadmium Compounds
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Primary Aluminum Production		
Primary Aluminum	3334	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
Primary Battery, Dry and Wet Manufacture		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Primary Batteries, Dry And Wet	3692	
		Cadmium Compounds
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Primary Copper (not subject to Primary Copper Smelting MACT)		
Primary Copper	3331	
		Arsenic Compounds
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Nickel Compounds
		Styrene
Primary Metal Products Manufacturing		
Primary Metal Products, Nec	3399	
		Cadmium Compounds
		Chromium Compounds
		Formaldehyde
		Hydrazine
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Primary Nonferrous Metals Production		
Primary Nonferrous Metals, Nec	3339	
		Arsenic Compounds
		Beryllium Compounds
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
Primary Smelting and Refining of Zinc		
Primary smelting and refining of zinc (disc. 1987,	3333	
		Arsenic Compounds
		Lead Compounds
		Manganese Compounds
Printing Ink		
Printing Ink	2893	
		bis(2-Ethylhexyl)phthalate
		Carbon Tetrachloride
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
Printing Trades Machinery Manufacturing		
Printing Trades Machinery	3555	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Ethylene Dichloride
		Lead Compounds
		Methylene Chloride
Printing, Coating, and Dyeing of Fabrics		
Broadwoven Fabric Mills, Cotton	2211	
		Formaldehyde
Broadwoven Fabric Mills, Manmade	2221	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
		Tetrachloroethylene
Broadwoven Fabric Mills, Wool	2231	
		Trichloroethylene
Carpets And Rugs	2273	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chromium Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
Coated Fabrics, Not Rubberized	2295	
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Chromium Compounds
		Formaldehyde
		Lead Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Trichloroethylene
Cordage And Twine	2298	
		Lead Compounds
		Methylene Chloride
Finishing Plants, Cotton	2261	
		Formaldehyde
		Tetrachloroethylene
Finishing Plants, Manmade	2262	
		Formaldehyde
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Finishing Plants, Nec	2269	
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Knit Outerwear Mills	2253	
		Tetrachloroethylene
Knitting Mills, Nec	2259	
		Formaldehyde

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Tetrachloroethylene
Nonwoven Fabrics	2297	
		bis(2-Ethylhexyl)phthalate
		Formaldehyde
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
Textile Goods, Nec	2299	
		Formaldehyde
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Thread Mills	2284	
		Formaldehyde
		Methylene Chloride
Throwing And Winding Mills	2282	
		Methylene Chloride
Weft Knit Fabric Mills	2257	
		Formaldehyde
		Tetrachloroethylene
Yarn Spinning Mills	2281	
		bis(2-Ethylhexyl)phthalate
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
Printing/Publishing (Surface Coating)		
Bags: Plastics, Laminated, & Coated	2673	
		Methylene Diphenyl Diisocyanate
		Tetrachloroethylene
Book Printing	2732	
		Styrene
Commercial Printing, Gravure	2754	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Commercial Printing, Nec	2759	
		Methylene Chloride
		Tetrachloroethylene
Converted paper and paperboard products, nec (disc)	2649	
		Arsenic Compounds
		bis(2-Ethylhexyl)phthalate
		Formaldehyde
		Methylene Chloride
		Tetrachloroethylene
Greeting Cards	2771	
		Lead Compounds
		Methylene Chloride
		Tetrachloroethylene
Hard Surface Floor Coverings, Nec	3996	
		bis(2-Ethylhexyl)phthalate
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
Metal Foil And Leaf	3497	
		Chromium Compounds
		Lead Compounds
		Nickel Compounds
Paper Coated & Laminated, Packaging	2671	
		bis(2-Ethylhexyl)phthalate
		Tetrachloroethylene
		Trichloroethylene
Periodicals	2721	
		Methylene Chloride
Printing And Publishing	2700	
		Tetrachloroethylene

Process Control Instruments

SIC Code Description	SIC Code	Pollutant
Process Control Instruments	3823	
		Chromium Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Trichloroethylene
Products of Purchased Glass		
Products Of Purchased Glass	3231	
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Pulp mills (not subject to Pulp and Paper MACT)		
Pulp mills	2611	
		Chloroform
		Chromium Compounds
		Formaldehyde
		Mercury Compounds
Pumps and Pumping Equipment Manufacturing		
Pumps And Pumping Equipment	3561	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Radio and Television Communications Equipment (3662)		
Radio and Television Communications Equipment	3662	
		Lead Compounds
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Radio and Television Communications Equipment (3663)		
Radio & TV Communications Equipment	3663	
		Chromium Compounds
		Lead Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Trichloroethylene
Railroad Equipment Manufacturing		
Railroad Equipment	3743	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Trichloroethylene
Reconstituted Wood Products		
Reconstituted Wood Products	2493	
		Formaldehyde
		Methylene Diphenyl Diisocyanate
Refuse Systems		
Refuse Systems	4953	
		Ethylene Oxide
		Methylene Chloride
		Tetrachloroethylene
Relays and Industrial Controls		
Relays And Industrial Controls	3625	
		Formaldehyde
		Lead Compounds
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Rental Of Railroad Cars		
Rental Of Railroad Cars	4741	
		Methylene Chloride
Residential lighting fixtures		
Residential Lighting Fixtures	3645	
		Tetrachloroethylene
		Trichloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Robes and Dressing Gowns		
Robes And Dressing Gowns	2384	
		Tetrachloroethylene
Rolling Mill Machinery		
Rolling Mill Machinery	3547	
		Chromium Compounds
		Nickel Compounds
Roofing, Siding, And Sheet Metal Work		
Roofing, Siding, And Sheet Metal Work	1761	
		Methylene Diphenyl Diisocyanate
Rubber & Misc. Plastic Products		
Rubber And Misc. Plastics Products	3040	
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Styrene
Rubber and Plastic Footwear		
Rubber And Plastics Footwear	3021	
		bis(2-Ethylhexyl)phthalate
Rubber and Plastic Footwear Manufacturing		
Rubber And Plastics Footwear	3020	
		bis(2-Ethylhexyl)phthalate
Rubber and Plastic Hose and Belting		
Rubber and plastic hose and belting (disc. 1987)	3041	
		Tetrachloroethylene
Rubber and Plastic Hose and Belting Manufacturing		
Rubber & Plastics Hose & Belting	3052	
		1,1,2,2-Tetrachloroethane
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Tetrachloroethylene
		Trichloroethylene
Sanitary Food Containers		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Sanitary Food Containers	2656	
		Tetrachloroethylene
Saw Blades and Handsaws		
Saw Blades And Handsaws	3425	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Trichloroethylene
Sawmills and Planing Mills, general		
Sawmills And Planing Mills, General	2421	
		Arsenic Compounds
		Chromium Compounds
		Formaldehyde
Screw Machine Products Manufacturing		
Screw Machine Products	3451	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Search and Navigation Equipment		
Search and Navigation Equipment	3812	
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Secondary Nonferrous Metals		
Secondary Nonferrous Metals	3340	
		Tetrachloroethylene
Secondary Nonferrous Metals Production		
Secondary Nonferrous Metals	3341	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Arsenic Compounds
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Semiconductor Manufacturing		
Semiconductors And Related Devices	3674	
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Sheet Metal Work		
Sheet Metalwork	3444	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Tetrachloroethylene
		Trichloroethylene
Ship and Boat Building (not subject to Boats Manufacturing MACT)		
Ship and Boat Building and Repairing	3730	
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Styrene
Silverware and Plated Ware		
Silverware And Plated Ware	3914	
		Lead Compounds
		Nickel Compounds
		Styrene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Trichloroethylene
Small Arms		
Small Arms	3484	
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
Small Arms Ammunition		
Small Arms Ammunition	3482	
		Arsenic Compounds
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Soap and Other Detergents Manufacturing		
Soap And Other Detergents	2841	
		1,4-Dichlorobenzene
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Dichloride
		Ethylene Oxide
		Formaldehyde
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
Soaps, Cleaners, and Toilet Goods		
Soap, Cleaners, And Toilet Goods	2840	
		1,4-Dichlorobenzene
		Formaldehyde
		Methylene Chloride
		Tetrachloroethylene

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Softwood Veneer and Plywood		
Softwood Veneer And Plywood	2436	
		Formaldehyde
		Methylene Diphenyl Diisocyanate
Space Propulsion Units and Parts Manufacturing		
Space Propulsion Units And Parts	3764	
		Ethylene Dichloride
		Hydrazine
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Space Research and Technology		
Space Research And Technology	9661	
		Benzene
		Cadmium Compounds
		Carbon Tetrachloride
		Chloroform
		Chromium Compounds
		Ethylene Dichloride
		Formaldehyde
		Lead Compounds
		Manganese Compounds
		Mercury Compounds
		Methylene Chloride
		Nickel Compounds
		Trichloroethylene
Space Vehicle Parts and Equipment, nec		
Space Vehicle Equipment, Nec	3769	
		Chromium Compounds
		Lead Compounds
		Methylene Chloride
		Tetrachloroethylene
		Trichloroethylene
Special Dies, Tools, Jigs and Fixtures		
Special Dies, Tools, Jigs & Fixtures	3544	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Special Industry Machinery Manufacturing		
Special Industry Machinery	3550	
		1,1,2-Trichloroethane
Special Industry Machinery, nec		
Special Industry Machinery, Nec	3559	
		Chromium Compounds
		Ethylene Oxide
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Special Trade Contractors, nec		
Special Trade Contractors, Nec	1799	
		Styrene
Speed Changers, Drives, and Gears		
Speed Changers, Drives, And Gears	3566	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Steel and Iron Reclamation- Auto Scrap Burning		
Scrap And Waste Materials	5093	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds

112(k) Source Category

	SIC Code Description	SIC Code	Pollutant
Steel Foundries			
	Steel Foundries, Nec	3325	
			Chromium Compounds
			Formaldehyde
			Lead Compounds
			Manganese Compounds
			Methylene Chloride
			Nickel Compounds
	Steel Investment Foundries	3324	
			1,1,2-Trichloroethane
			Chromium Compounds
			Formaldehyde
			Lead Compounds
			Manganese Compounds
			Methylene Chloride
			Nickel Compounds
			Tetrachloroethylene
			Trichloroethylene
Steel Pipe and Tubes Manufacturing			
	Steel Pipe And Tubes	3317	
			Chromium Compounds
			Lead Compounds
			Manganese Compounds
			Methylene Chloride
			Nickel Compounds
			Tetrachloroethylene
			Trichloroethylene
Steel Springs, Except Wire			
	Steel Springs, Except Wire	3493	
			Chromium Compounds
			Methylene Chloride
			Nickel Compounds
			Tetrachloroethylene
Steel Wire and Related Products Manufacturing			
	Steel Wire And Related Products	3315	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Storage Batteries Manufacturing		
Storage Batteries	3691	
		Arsenic Compounds
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Trichloroethylene
Surface Active Agents Manufacturing		
Surface Active Agents	2843	
		Acrylonitrile
		Chromium Compounds
		Ethylene Oxide
		Formaldehyde
		Methyl Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
Surgical and Medical Instruments Manufacturing		
Surgical And Medical Instruments	3841	
		1,1,2-Trichloroethane
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Ethylene Oxide
		Manganese Compounds
		Methylene Chloride

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Nickel Compounds
		Trichloroethylene
Surgical Appliances and Supplies Manufacturing		
Surgical Appliances And Supplies	3842	
		Chromium Compounds
		Methylene Chloride
Switchgear and Switchboard Apparatus		
Switchgear and Switchboard Apparatus	3613	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Tanks and Tank Components Manufacturing		
Tanks And Tank Components	3795	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Styrene
Telephone and Telegraph Apparatus		
Telephone And Telegraph Apparatus	3661	
		Formaldehyde
		Lead Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Textile Machinery		
Textile Machinery	3552	
		Chromium Compounds
		Lead Compounds
		Nickel Compounds

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Trichloroethylene
Tire Cord And Fabrics		
Tire Cord And Fabrics	2296	
		Formaldehyde
		Lead Compounds
		Methylene Diphenyl Diisocyanate
		Styrene
Tires and Inner Tubes (not subject to Tire Production MACT)		
Tires And Inner Tubes	3011	
		Formaldehyde
		Methylene Diphenyl Diisocyanate
		Trichloroethylene
Toilet Preparations Manufacturing		
Toilet Preparations	2844	
		Ethylene Oxide
		Formaldehyde
		Tetrachloroethylene
Toys and Sporting Goods		
Toys And Sporting Goods	3940	
		Methylene Chloride
Transformers, Except Electronic		
Transformers, Except Electronic	3612	
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Polycyclic Organic Matter as 16-PAH
		Styrene
		Tetrachloroethylene
		Trichloroethylene
Transmitting, Industrial and Special Purpose Elect		
Transmitting, industrial and special purpose elect	3673	
		Nickel Compounds
Transportation Equipment		

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Transportation Equipment	3700	
		Methylene Chloride
		Styrene
		Tetrachloroethylene
Travel Trailers and Campers Manufacturing		
Travel Trailers And Campers	3792	
		Methylene Chloride
Trucking, Except Local		
Trucking, Except Local	4213	
		Tetrachloroethylene
Turbines and Turbine Generator Sets		
Turbines And Turbine Generator Sets	3511	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
		Styrene
Typewriters Computer Storage Devices		
Computer Storage Devices	3572	
		Chromium Compounds
Unsupported Plastics Film & Sheet		
Unsupported Plastics Film & Sheet	3081	
		Acetaldehyde
		Acrylonitrile
		bis(2-Ethylhexyl)phthalate
		Cadmium Compounds
		Chloroform
		Chromium Compounds
		Ethyl Acrylate
		Ethylene Oxide
		Lead Compounds
		Methylene Chloride
		Styrene
		Trichloroethylene
		Vinyl Chloride
		Vinylidene Chloride

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
Unsupported Plastics Profile Shapes		
Unsupported Plastics Profile Shapes	3082	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Diphenyl Diisocyanate
Upholstered Household Furniture		
Upholstered Household Furniture	2512	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
Valves and Pipe Fittings Manufacturing		
Valves And Pipe Fittings, Nec	3494	
		Cadmium Compounds
		Chromium Compounds
		Lead Compounds
		Manganese Compounds
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
		Nickel Compounds
		Tetrachloroethylene
		Trichloroethylene
Vegetable Oil Mills, nec		
Vegetable Oil Mills, Nec	2076	
		Methylene Diphenyl Diisocyanate
Watches, Clocks, Watchcases, and Parts		
Watches, Clocks, Watchcases & Parts	3873	
		Trichloroethylene
Water, Sewer, and Utility Lines		
Water, Sewer, And Utility Lines	1623	
		Styrene
Welding Apparatus		
Welding Apparatus	3548	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Tetrachloroethylene
Welding Apparatus, Electric		
Welding apparatus, electric (disc. 1987, 3548)	3623	
		Chromium Compounds
		Manganese Compounds
		Nickel Compounds
Wet Corn Milling		
Wet Corn Milling	2046	
		1,3-Butadiene
		Acetaldehyde
		Ethylene Oxide
		Styrene
Wire Springs		
Wire Springs	3495	
		Chromium Compounds
		Manganese Compounds
		Methylene Chloride
		Nickel Compounds
		Trichloroethylene
Women's Footwear, Except Athletic		
Women's Footwear, Except Athletic	3144	
		1,1,2-Trichloroethane
		Methylene Chloride
Wood Building Products (Surface Coating)		
Hardwood Dimension & Flooring Mills	2426	
		Styrene
Millwork	2431	
		bis(2-Ethylhexyl)phthalate
		Methylene Chloride
		Tetrachloroethylene
Mobile Homes	2451	

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Diphenyl Diisocyanate
Prefabricated Wood Buildings	2452	
		Methylene Chloride
		Methylene Diphenyl Diisocyanate
Wood Furniture (Surface Coating)		
Furniture And Fixtures	2500	
		Formaldehyde
		Methylene Chloride
Furniture And Fixtures, Nec	2599	
		Formaldehyde
		Tetrachloroethylene
		Trichloroethylene
Household Furniture, Nec	2519	
		Methylene Chloride
Wood Household Furniture	2511	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Formaldehyde
		Manganese Compounds
		Methylene Chloride
		Polycyclic Organic Matter as 16-PAH
		Styrene
Wood Kitchen Cabinets	2434	
		bis(2-Ethylhexyl)phthalate
		Formaldehyde
		Methylene Chloride
Wood Office Furniture	2521	
		bis(2-Ethylhexyl)phthalate
		Chromium Compounds
		Formaldehyde
		Methylene Chloride
		Nickel Compounds
		Styrene
Wood Tv And Radio Cabinets	2517	
		Formaldehyde

112(k) Source Category

SIC Code Description	SIC Code	Pollutant
		Methylene Chloride
Wood Partitions and Fixtures		
Wood Partitions And Fixtures	2541	
		Methylene Chloride
		Trichloroethylene
Wood Preserving		
Wood Preserving	2491	
		Arsenic Compounds
		Benzene
		Chromium Compounds
		Formaldehyde
		Methylene Chloride
		Quinoline
		Styrene
Wood Products		
Wood Products, Nec	2499	
		bis(2-Ethylhexyl)phthalate
		Formaldehyde
		Methylene Chloride
		Styrene
		Trichloroethylene
X-ray Apparatus and Tubes		
X-ray Apparatus And Tubes	3844	
		Lead Compounds

Appendix D

Facility Lists That Were Used To Adjust TRI Data To Avoid Double Counting

For some source categories, facility-specific emission estimates were provided. Many of these facilities reported to TRI. To avoid double counting, these facilities were removed from the TRI data set used for this inventory. In one case, primary lead, only the mercury estimates reported to TRI were removed. All other pollutants for the facilities reporting to TRI were retained in the inventory. To identify source categories for which this adjustment was made, review Table 8-1. This appendix provides the facilities removed from the data set and is organized first by source category, then by facility. The facility identification code is shown as well.

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Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
Acrylic Fibers/Modacrylic Fibers Production		
	AMOCO PERFORMANCE PRODUCTS INC.	29602MCPRFPOBOX
	HISPAN CORP.	35603HSPNC3300M
	MONSANTO CO.	35601MNSNTCOURT
Cadmium Refining and Cadmium Oxide Production		
	ASARCO INC. GLOBE PLANT	80216SRCNC495EA
	BIG RIVER ZINC CORP.	62201BGRVRRTE3M
	JERSEY MINIERE ZINC	37041JRSYMZINCP
	ZINC CORP. OF AMERICA	74003ZNCCR11THA
Cadmium Stabilizers for Plastics		
	ACHILLES USA INC.	98203KHKKS14078
	ALPHAGARY CORP.	01453GRYCHPIONE
	BF GOODRICH CO.	08067THBFGUSROU
	EMPIRE PLASTICS INC.	43832DVRSTONEGE
	GE CO. GE CHEMICALS INC.	26181BRGWRSTATE
	GE CO. PLASTICS	12158GNRLLNORYL
	HULS AMERICA INC.	18707DYNMTCREST
	IPC INC. CORINTH DIV.	38834PCCRNGOLDI
	MONSANTO CO.	45001MNSNTRIVER
	NORTH AMERICAN PLASTICS INC.	39756NRTHMABERD
	O'SULLIVAN CORP.	17042SLLVN1501W
	O'SULLIVAN CORP.	22601SLLVN1944V
	O'SULLIVAN PLASTICS CORP.	89447SLLVN270NO
	REGALITE PLASTICS CORP.	02164RGLTP300NE
	RIMTEC CORP.	08016FRNKLBEVER
	RJF INTL. CORP.	45750BFGDRBFGOO
	ROHM & HAAS CO.	19007RHMNDOLDRT
	STANDARD PRODS. CO.	29180STNDRPOBOX
	SYNTHETIC PRODS. CO.	06497SYNTH1525S
	VYTRON CORP.	37774VYTRNPOBOX
Cadmium Stabilizers Production		
	AKZO CHEMICALS INC.	08903KZCHM500JE

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	FERRO CORP. BEDFORD CHEMICAL DIV.	44146FRRCR7050K
	ROHM & HAAS CO.	19007RHMNDOLDRT
	SYNTHETIC PRODS. CO.	06497SYNTH1525S
	VANDERBILT CHEMICAL CORP.	06801VNDRB31TAY
	WITCO CORP. ARGUS DIV.	11231RGSDV633CO
Carbamate Insecticides Production		
	RHONE-POULENC INSTITUTE PLANT	25112RHNPLROUTE
Carbon Black Production		
	DEGUSSA CORP. BELPRE	45714SHLNDHWY7N
Chemical Manufacturing: ABS Resins		
	DOW CHEMICAL CO. HANGING ROCK PLANT	45638DWCHMOLDHI
	DOW CHEMICAL CO. TORRANCE CA.	90503DWCHM305CR
	DOW CHEMICAL USA MIDLAND SITE	48667THDWCMICHI
	DOW NORTH AMERICA ALLYN'S POINT PLANT	06335DWCHMROUTE
	GE CO. CHEMICALS	61350BRGWRCANAL
	GE CO. GE CHEMICALS INC.	26181BRGWRSTATE
	MONSANTO CO.	45001MNSNTRIVER
	MONSANTO CO.	52761MNSNTWIGGI
Chemical Manufacturing: Chloroform Production		
	DOW CHEMICAL CO. LOUISIANA DIV.	70765THDWCHIGHW
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	HANLIN CHEMICALS WEST VIRGINIA INC.	26041LCPCHROUTE
	OCCIDENTAL CHEMICAL CORP.	25015CCDNTDUPON
	VULCAN CHEMICALS	67215VLCNC6200S
	VULCAN MATERIALS CO. CHEMICALS DIV.	70734VLCNMASHLA
Chemical Manufacturing: Chloroform Production (Storage Emissions)		
	DOW CHEMICAL CO. LOUISIANA DIV.	70765THDWCHIGHW
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	HANLIN CHEMICALS WEST VIRGINIA INC.	26041LCPCHROUTE
	OCCIDENTAL CHEMICAL CORP.	25015CCDNTDUPON
	VULCAN CHEMICALS	67215VLCNC6200S
	VULCAN MATERIALS CO. CHEMICALS DIV.	70734VLCNMASHLA

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
Chemical Manufacturing: Chloromethanes Production		
	DOW CHEMICAL CO. LOUISIANA DIV.	70765THDWCHIGHW
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	DOW CORNING CORP.	41008DWCRNUSHIG
	DOW CORNING CORP. MIDLAND SITE	48686DWCRN3901S
	GE CO. SILICONE PRODS.	12188GNRLL260HU
	HANLIN CHEMICALS WEST VIRGINIA INC.	26041LCPCHROUTE
	VULCAN MATERIALS CO. CHEMICALS DIV.	70734VLCNMASHLA
Chemical Manufacturing: Chromium Compounds		
	OCCIDENTAL CHEMICAL CORP. CASTLE HAYNE PLANT	28429CCDNTOFFST
Chemical Manufacturing: Methyl Chloroform		
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	PPG INDUSTRIES INC.	70669PPGNDCOLUM
	VULCAN MATERIALS CO. CHEMICALS DIV.	70734VLCNMASHLA
Chemical Manufacturing: Naphthalene		
	ALLIED-SIGNAL INC.	45638LLDSG3330S
	KOPPERS IND. INC. FOLLANSBEE TAR PLANT	26037KPPRSKOPPE
Chemical Manufacturing: Naphthalene Sulfonates		
	AMERICAN CYANAMID CO.	45750MRCNC1405G
Chemical Manufacturing: p-Dichlorobenzene (1,4-)		
	MONSANTO CO.	62206MNSNT500MO
	STANDARD CHLORINE OF DELAWARE INC.	19706STNDRGOVER
Chemical Manufacturing: p-Dichlorobenzene (Storage Emissions)		
	MONSANTO CO.	62206MNSNT500MO
	STANDARD CHLORINE OF DELAWARE INC.	19706STNDRGOVER
Chemical Manufacturing: Phenol Manufacturing		
	ALLIED-SIGNAL INC. FRANKFORD PLANT	19137LLDSGMARGA
	ARISTECH CHEMICAL CORP.	45636RSTCHRT52A
	BTL SPECIALTY RESINS CORP.	60406BTLSP131ST
	GEORGIA GULF CORP.	70765GRGGLHIGHW
	SHELL OIL CO. DEER PARK	77536SHLLLHIGHW
	TEXACO REFINING & MARKETING INC.	67042TXCRF1401S

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
Chemical Manufacturing: Styrene		
	AMOCO CHEMICAL CO. TEXAS CITY PLANT A	77592MCCHMFOOTO
	ARCO CHEMICAL CO.	15061RCCHMFRANK
	ARCO CHEMICAL CO.	77530RCCHM2502S
	CHEVRON CHEMICAL CO. ST. JAMES PLANT	70086CHVRNHWY18
	COSMAR CO.	70721CSMRPLAHWY
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	REXENE PRODUCTS CO. POLYPROPYLENE PLANT	79760LPSPR2400S
	STERLING CHEMICALS INC.	77592STRLN201BA
Chemical Manufacturing: Styrene (Storage Emissions)		
	AMOCO CHEMICAL CO. TEXAS CITY PLANT A	77592MCCHMFOOTO
	ARCO CHEMICAL CO.	15061RCCHMFRANK
	ARCO CHEMICAL CO.	77530RCCHM2502S
	CHEVRON CHEMICAL CO. ST. JAMES PLANT	70086CHVRNHWY18
	COSMAR CO.	70721CSMRPLAHWY
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	REXENE PRODUCTS CO. POLYPROPYLENE PLANT	79760LPSPR2400S
	STERLING CHEMICALS INC.	77592STRLN201BA
Chemical Manufacturing: Styrene-Butadiene Copolymer Latexes		
	BASF CORP.	37421PLYSR2200P
	BASF CORP. DISPERSIONS FACILITY	15061PLYSR370FR
	BF GOODRICH ADHESIVES SYS. DIV.	44311BFGDR123WB
	BF GOODRICH TEXTILE COATINGS	28054WLSHC207TE
	DOW CHEMICAL CO.	94565DWCHMFOOTO
	DOW CHEMICAL CO. DALTON GEORGIA PLANT	30720DWCHM1468P
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	DOW CHEMICAL USA MIDLAND SITE	48667THDWCMICHI
	DOW NORTH AMERICA ALLYN'S POINT PLANT	06335DWCHMROUTE
	GENCORP INC. SPECIALTY POLYMERS DIV.	44260DVRST165SC
	GOODYEAR TIRE & RUBBER CO.	30701THGDY1601H
	GOODYEAR TIRE & RUBBER CO. HOUSTON CHEMICAL PL	77262GDYRT2000G
	REICHHOLD CHEMICALS INC.	19936RCHHLCOUNT

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	REICHHOLD CHEMICALS INC.	30707RCHHLROUTE
	UNOCAL CORP. UNOCAL CHEMICAL DIV.	28213NCLCH14700
	W. R. GRACE & CO. CONN.	42303WRGRC5525U
Chemical Manufacturing: Tetrachloroethylene		
	DOW CHEMICAL CO.	94565DWCHMFOOTO
	DOW CHEMICAL CO. LOUISIANA DIV.	70765THDWCHIGHW
	OCCIDENTAL CHEMICAL CORP. DEER PARK SITE	77536CCDNT1000T
	PPG INDUSTRIES INC.	70669PPGNDCOLUM
	VULCAN CHEMICALS	67215VLCNC6200S
	VULCAN MATERIALS CO. CHEMICALS DIV.	70734VLCNMASHLA
Chemical Manufacturing: Trichloroethylene		
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	PPG INDUSTRIES INC.	70669PPGNDCOLUM
Coke By-Product Plants		
	ACME STEEL CO. CHICAGO COKE PLANT	60617CMSTL11236
	ARMCO STEEL CO. L.P. COKE PLANT	41105RMCST4000E
	ARMCO STEEL CO. L.P. MIDDLETOWN PLANT	45043RMCNC1801C
	BETHLEHEM STEEL CORP. BURNS HARBOR PLANT	46304BTHLHBURNS
	BETHLEHEM STEEL CORP. LACKAWANNA COKE DIV.	14218BTHLHPOBOX
	BETHLEHEM STEEL STRUCTURAL PRODS. CORP. METALS	18016BTHLH501EA
	CITIZENS GAS & COKE UTILITY MFG. DIV.	46203CTZNS2950E
	DRUMMOND CO.INC. ABC COKE DIV. TARRANT COKE PL	35217BCCKDRAILR
	EMPIRE COKE CO.	35404MPRCKENDOF
	ERIE COKE CORP.	16512RCKCRFOOTO
	GENEVA STEEL	84057GNVST1600W
	GRANITE CITY STEEL	62040GRNTC20THS
	GULF STATES STEEL INC.	35904GLFST174SO
	KOPPERS IND. INC. MONESSEN COKE PLANT	15062MNSSN345DO
	KOPPERS IND. INC. WOODWARD COKE PLANT	35061KPPRS2134K
	LTV STEEL CO.	60617LTVST11600
	LTV STEEL CO. INC. PITTSBURGH WORKS	15207PTTSB4650S
	LTV STEEL CO. INC. WARREN COKE PLANT	44482LTVST2234M

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	NATIONAL STEEL CORP. GREAT LAKES DIV.	48229GRTLKNO1QU
	NEW BOSTON COKE CORP.	45662NWBST600RI
	SHENANGO INC.	15225SHNNG200NE
	SLOSS INDUSTRIES CORP. BIRMINGHAM FACILITY	35207SLSSN35003
	TONAWANDA COKE CORP.	14150TNWND3875R
	U.S. STEEL USS GARY WORKS	46402SSGRYONENO
	USS CLAIRTON WORKS	15025SSCLR400ST
	WHEELING-PITTSBURGH STEEL CORP STEUBENVILLE EA	26037WHLNGROUTE
Coke Ovens: Emergency Releases		
	ACME STEEL CO. CHICAGO COKE PLANT	60617CMSTL11236
	ARMCO STEEL CO. L.P. COKE PLANT	41105RMCST4000E
	ARMCO STEEL CO. L.P. MIDDLETOWN PLANT	45043RMCNC1801C
	BETHLEHEM STEEL CORP. BURNS HARBOR PLANT	46304BTHLHBURNS
	BETHLEHEM STEEL CORP. LACKAWANNA COKE DIV.	14218BTHLHPOBOX
	BETHLEHEM STEEL STRUCTURAL PRODS. CORP. METALS	18016BTHLH501EA
	CITIZENS GAS & COKE UTILITY MFG. DIV.	46203CTZNS2950E
	DRUMMOND CO.INC. ABC COKE DIV. TARRANT COKE PL	35217BCCKDRAILR
	EMPIRE COKE CO.	35404MPRCKENDOF
	ERIE COKE CORP.	16512RCKCRFOOTO
	GENEVA STEEL	84057GNVST1600W
	GRANITE CITY STEEL	62040GRNTC20THS
	GULF STATES STEEL INC.	35904GLFST174SO
	KOPPERS IND. INC. MONESSEN COKE PLANT	15062MNSSN345DO
	KOPPERS IND. INC. WOODWARD COKE PLANT	35061KPPRS2134K
	LTV STEEL CO.	60617LTVST11600
	LTV STEEL CO. INC. PITTSBURGH WORKS	15207PTTSB4650S
	LTV STEEL CO. INC. WARREN COKE PLANT	44482LTVST2234M
	NATIONAL STEEL CORP. GREAT LAKES DIV.	48229GRTLKNO1QU
	NEW BOSTON COKE CORP.	45662NWBST600RI
	SHENANGO INC.	15225SHNNG200NE
	SLOSS INDUSTRIES CORP. BIRMINGHAM FACILITY	35207SLSSN35003
	TONAWANDA COKE CORP.	14150TNWND3875R

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112(k) Source Category	Facility Name	TRI ID
	U.S. STEEL USS GARY WORKS	46402SSGRYONENO
	USS CLAIRTON WORKS	15025SSCLR400ST
	WHEELING-PITTSBURGH STEEL CORP STEUBENVILLE EA	26037WHLNGROUTE
Coke Ovens: Charging, Top Side, and Door Leaks		
	ACME STEEL CO. CHICAGO COKE PLANT	60617CMSTL11236
	ARMCO STEEL CO. L.P. COKE PLANT	41105RMCST4000E
	ARMCO STEEL CO. L.P. MIDDLETOWN PLANT	45043RMCNC1801C
	BETHLEHEM STEEL CORP. BURNS HARBOR PLANT	46304BTHLHBURNS
	BETHLEHEM STEEL CORP. LACKAWANNA COKE DIV.	14218BTHLHPOBOX
	BETHLEHEM STEEL STRUCTURAL PRODS. CORP. METALS	18016BTHLH501EA
	CITIZENS GAS & COKE UTILITY MFG. DIV.	46203CTZNS2950E
	DRUMMOND CO.INC. ABC COKE DIV. TARRANT COKE PL	35217BCCKDRAILR
	EMPIRE COKE CO.	35404MPRCKENDOF
	ERIE COKE CORP.	16512RCKCRFOOTO
	GENEVA STEEL	84057GNVST1600W
	GRANITE CITY STEEL	62040GRNTC20THS
	GULF STATES STEEL INC.	35904GLFST174SO
	KOPPERS IND. INC. MONESSEN COKE PLANT	15062MNSSN345DO
	KOPPERS IND. INC. WOODWARD COKE PLANT	35061KPPRS2134K
	LTV STEEL CO.	60617LTVST11600
	LTV STEEL CO. INC. PITTSBURGH WORKS	15207PTTSB4650S
	LTV STEEL CO. INC. WARREN COKE PLANT	44482LTVST2234M
	NATIONAL STEEL CORP. GREAT LAKES DIV.	48229GRTLKNO1QU
	NEW BOSTON COKE CORP.	45662NWBST600RI
	SHENANGO INC.	15225SHNNG200NE
	SLOSS INDUSTRIES CORP. BIRMINGHAM FACILITY	35207SLSSN35003
	TONAWANDA COKE CORP.	14150TNWND3875R
	U.S. STEEL USS GARY WORKS	46402SSGRYONENO
	USS CLAIRTON WORKS	15025SSCLR400ST
	WHEELING-PITTSBURGH STEEL CORP STEUBENVILLE EA	26037WHLNGROUTE
Coke Ovens: Pushing, Quenching, and Battery Stacks		
	ACME STEEL CO. CHICAGO COKE PLANT	60617CMSTL11236

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112(k) Source Category	Facility Name	TRI ID
	ARMCO STEEL CO. L.P. COKE PLANT	41105RMCST4000E
	ARMCO STEEL CO. L.P. MIDDLETOWN PLANT	45043RMCNC1801C
	BETHLEHEM STEEL CORP. BURNS HARBOR PLANT	46304BTHLHBURNS
	BETHLEHEM STEEL CORP. LACKAWANNA COKE DIV.	14218BTHLHPOBOX
	BETHLEHEM STEEL STRUCTURAL PRODS. CORP. METALS	18016BTHLH501EA
	CITIZENS GAS & COKE UTILITY MFG. DIV.	46203CTZNS2950E
	DRUMMOND CO.INC. ABC COKE DIV. TARRANT COKE PL	35217BCCKDRAILR
	EMPIRE COKE CO.	35404MPRCKENDOF
	ERIE COKE CORP.	16512RCKCRFOOTO
	GENEVA STEEL	84057GNVST1600W
	GRANITE CITY STEEL	62040GRNTC20THS
	GULF STATES STEEL INC.	35904GLFST174SO
	KOPPERS IND. INC. MONESSEN COKE PLANT	15062MNSSN345DO
	KOPPERS IND. INC. WOODWARD COKE PLANT	35061KPPRS2134K
	LTV STEEL CO.	60617LTVST11600
	LTV STEEL CO. INC. PITTSBURGH WORKS	15207PTTSB4650S
	LTV STEEL CO. INC. WARREN COKE PLANT	44482LTVST2234M
	NATIONAL STEEL CORP. GREAT LAKES DIV.	48229GRTLKNO1QU
	NEW BOSTON COKE CORP.	45662NWBST600RI
	SHENANGO INC.	15225SHNNG200NE
	SLOSS INDUSTRIES CORP. BIRMINGHAM FACILITY	35207SLSSN35003
	TONAWANDA COKE CORP.	14150TNWND3875R
	U.S. STEEL USS GARY WORKS	46402SSGRYONENO
	USS CLAIRTON WORKS	15025SSCLR400ST
	WHEELING-PITTSBURGH STEEL CORP STEUBENVILLE EA	26037WHLNGROUTE
Flexible Polyurethane Foam Production		
	ADVANCED FOAM & PLASTICS CO.	44111DVNCD3431W
	ALADDIN INDUSTRIES INC.	37210LDDNN703MU
	ALLEN FOAM CORP.	90224LLNFM175EA
	ASHTABULA RUBBER CO.	44004SHTBL2751W
	AUSTIN URETHANE INC.	31709STNRTSOUTH
	AUTOMOTIVE IND. INC.	22657TMTVNEASTQ

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112(k) Source Category	Facility Name	TRI ID
	BASF CORP. CHEMICAL ENG. R & D	48192BSFCR1609B
	BUCKEYE RUBBER PRODUCTS INC.	45802BCKYR637NJ
	BURKART FOAM INC.	62914BRKRT36THS
	CARPENTER CO.	23234RCRPN2400J
	CARPENTER CO.	28613RCRPNBOX87
	CARPENTER CO.	38879RCRPNLEEIN
	COLEMAN OUTDOOR PRODUCTS INC.	67201THCLM3600N
	COOPER INDUSTRIES INC. BUSSMANN DIV.	63021BSSMN114OL
	CRAIN IND. INC.	28613CRNND117MC
	CRAIN IND. INC.	33166FLRFM7485N
	CRAIN IND. INC. COMPTON DIV.	90224CRNND19201
	CRAIN IND. INC. ELKHART DIV.	46516CRNND1806C
	CRAIN IND. INC. KENT DIV.	98032CRNND19635
	CRAIN IND. NEWNAN DIV.	30263CRNND374CO
	CRAIN INDUSTRIES INC.	94577CRNND2451P
	CREATIVE URETHANES INC.	22132CRTVR310NO
	DELCO PRODUCTS (KETTERING OPERATIONS)	45420DLCPR2000F
	DOUGLAS & LOMASON CO.	21078DGLSL1601C
	DOUGLAS & LOMASON CO.	38358DGLSLKEFAU
	DOVE PRODUCTS INC.	60441DVPRD2231L
	DUBLON INC.	07105DBLNN84WAY
	E. R. CARPENTER CO. INC.	42276RCRPNFORRE
	E. R. CARPENTER CO. INC.	92504RCRPN7809L
	E. R. CARPENTER CO. INC.	95330RCRPN17100
	EAGLE-PICHER AUTOMOTIVE GROUP ORTHANE DIV.	76201HRBBR1500I
	EASTERN FOAM PRODS.	38501STRNF1227E
	EASTON FOAM CORP.	18042STNFM50HIL
	FOAM DESIGN INC.	40511FMDSG444TR
	FOAM MOLDERS & SPECIALTIES	90701FMMLD20004
	FOAMEX INTL. INC.	28031RVSBRHIGHW
	FOAMEX INTL. INC.	38358FMXPRKEFAU
	FOAMEX INTL. INC. DIV. OF KIHI	92408SCTFM1400E

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112(k) Source Category	Facility Name	TRI ID
	FOAMEX L.P.	46516FMXPR603IN
	FOAMEX L.P.	46706RVSBRCR427
	FOAMEX L.P.	46809SCTFM3005C
	FOAMEX L.P. LAPORTE	46350FMXLP401DA
	FOAMEX L.P. PLANT 1	37814FMXLP328HA
	FOAMEX LP	30207SCTFM1705A
	FOAMEX LP DIV. OF KIHI	16407FMXPR466SH
	FOAMEX LP DIV. OF KNOLL INT'L HOLDINGS	32821RVSBR1351G
	FOAMEX LP FOAMEX DIV.	19013SCTFM1500E
	FORD MOTOR CO. UTICA PLANT	48087FRDMT50500
	FUTURE FOAM INC.	51501FTRFM400N1
	FUTURE FOAM INC.	53562FTRFM2210P
	FUTURE FOAM INC.	67114FTRFM1500S
	GENERAL FOAM CORP.	18201GNRLFVALMO
	GENERAL FOAM CORP.	55108GNRLF1800C
	GENERAL FOAM CORP.	60455GNRLF7401S
	GENERAL PLASTICS MFG. CO.	98409GNRLP4910B
	GOODYEAR TIRE & RUBBER CO. PLANT I	43138GDYRT1689E
	GPI CORP.	54476GPCRP101NO
	H. L. BLACHFORD INC.	48083HLBLC1855S
	HEDSTROM CORP. PLASTICS DIV.	44805HDSTR710OR
	HICKORY SPRINGS MFG. CO.	28613HCKRYHIGHW
	HICKORY SPRINGS MFG. CO.	31709HCKRYSOUTH
	HICKORY SPRINGS MFG. CO.	38879HCKRYLIPPA
	HICKORY SPRINGS MFG. CO.	72902HCKRY4925S
	HICKORY SPRINGS OF CA	97230HCKRY3900N
	HICKORY SPRINGS OF CALIFORNIA	90023HCKRY4542E
	INTEGRAM ST LOUIS SEATING FOAM OPS	63069NTGRM1000I
	JOHNSON CONTROLS INC.	46777JHNSN2501E
	KERN FOAM PRODS. CORP.	07080KRNFM1253N
	LARSTAN IND. INC.	21740LRSTN9317E
	LEGGETT & PLATT URETHANE FOAM DIV.	38801LPFMN1118C

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	MIDWEST URETHANE PROCESSING INC.	67110MDWST110WM
	MONARCH INDUSTIRAL TIRE CORP.	44310TLDYN1460I
	MPI INC.	38618MPNC 485IN
	NO-SAG FOAM PRODUCTS CO. FOAM OPERATIONS	60185NSGPR1850W
	NORTH CAROLINA FOAM IND. INC.	27030NRTHC511CA
	NU-FOAM PRODS. INC.	37406NFMPR1101W
	OLYMPIC PRODUCTS CO.	38802LYMPC1116S
	PAGE BELTING CO.	03301PGBLT26COM
	PERRY CHEMICAL & MFG. CO. INC.	47902PRRYC2335S
	PRESTIGE FABRICATORS INC.	27203PRSTG2206D
	PRODUCTS RESEARCH & CHEMICAL CORP.	91203PRDCT5430S
	PUREFORMS INC.	97210PRFRM3319N
	RANDALL TEXTRON INC.	45177RNDLL474SN
	RENOSOL CORP. FARWELL PLANT	48622RNSLC505HO
	ROGERS CORP. PORON & COMPOSITES	06263RGRSCONETE
	ROGERS CORP. WILLIMANTIC	06226RGRSCRTE32
	SCOTT PORT-A-FOLD INC.	43502SCTTP100TA
	SEARS MFG. CO.	52808SRSMN1718S
	STEPHENSON & LAWYER INC.	49508STPHN3831P
	SWENSON CO.	54970SWNSN650WA
	SYNAIR CORP.	37406SYNRC2003A
	TEMPRESS INC.	98108TMPRS701SO
	TEXAS FIBERS	77833TXSFB1200R
	TEXTRON AUTOMOTIVE INTERIOR	03820DVDSNINDUS
	TRINITY FOAM OF CAROLINA	27263TRNTYHWY31
	VITAFOAM INC.	27263LPFMN2222S
	WOODBRIDGE CORP.	53520WDBRDTENEY
	WOODBRIDGE CORP.	63376WDBRD11CER
	WOODBRIDGE FOAM FABRICATING INC.	37406WDBRD100JU
	WOODBRIDGE GROUP CARTEX DIV.	19030CRTXC200RO
	WOODBRIDGE ROMULUS CORP.	48174WDBRD15573
Fluorocarbon Production		

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	ALLIED-SIGNAL INC. BATON ROUGE S.	70805LLDSGCORNE
	DU PONT CHAMBERS WORKS	08023DPNTCRT130
	ELF ATOCHEM N.A. INC. WICHITA PLANT	67215RCNNC6040S
	LAROCHE CHEMICALS INC.	70052LRCHCPOBOX
Formaldehyde, Acrolein, Acetaldehyde, Butyraldehyde Production		
	BASF CORP.	77541BSFCR602CO
	HOECHST-CELANESE CHEMICAL GROUP INC.	77414HCHSTPOBOX
	ROHM & HAAS OF TEXAS INC.	77536RHMND6600L
	TEXAS EASTMAN CO.	75607TXSSTOFFHI
	UNION CARBIDE CORP. TAFT/STAR COMPLEX	70057NNCRBHWY31
Friction Products Manufacturing		
	ADVANCED FRICTION MATERIALS	48078DVNCD44650
	ALLIED-SIGNAL INC. BRAKING SYS.	12183LLDSGTIBBE
	ALLIED-SIGNAL INC. BRAKING SYS.	37311LLDSG20THS
	BORG-WARNER AUTOMOTIVE TRANSMISSION & ENGINE	60104BRGWR700SO
	CATERPILLAR INC. MOSSVILLE ENG INE CENTER	61552CTRPLOLDGA
	GENUINE PARTS CO. RAYLOC DIV.	21750GNNPR100RA
	GENUINE PARTS CO. RAYLOC DIV.	76401GNNPR840SE
	GMC DELCO CHASSIS DIV. HOME AVE. OPS.	45417NLNDD2701H
	INERTIA DYNAMICS INC.	06022NRTDY146PO
	MANVILLE SALES CORP.	28352MNVLLPOBOX
	PRATTVILLE MFG. INC.	36067PRTTV101EC
	RAYBESTOS PRODS. CO.	47933RYBST1204D
	REXNORD CORP.	53214RXNRD4701W
Hazardous Waste Incineration		
	3M CHEMOLITE CENTER	55016MCHMLHIGHW
	AIR PRODS. & CHEMICALS INC.	08066RPRDCBILLI
	AKZO CHEMICALS INC.	60450KZCHMTABLE
	ALLIED-SIGNAL INC. FAIRFIELD PLANT	35224LLDSG1327E
	ALLIED-SIGNAL INC. HOPEWELL PLANT	23860LLDSGPOBOX
	AMERICAN CYANAMID CO.	26190MRCNCSTRT2
	AMOCO OIL CO. WHITING REFINERY	46394MCLC 2815I

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112(k) Source Category	Facility Name	TRI ID
	ARKANSAS EASTMAN CO. DIV. OF EASTMAN KODAK CO.	72503RKNSSSTATE
	ASH GROVE CEMENT CO.	66720SHGRVNORTH
	ASH GROVE CEMENT CO.	71836SHGRVPOBOX
	ASHLAND CHEMICAL INC. LOS ANGELES PLANT	90040SHLND6608E
	ATOCHEM N.A. INC.	41008MTCHM2316H
	ATOCHEM N.A. INC.	42029PNNWLALTON
	BASF CORP.	70734BSFCRRIVER
	BASF CORP.	77541BSFCR602CO
	BP CHEMICALS INC.	45805BPCHMFORTA
	BP CHEMICALS INC. GREEN LAKE	77979BPCHMTEXAS
	BURROUGHS WELLCOME CO.	27835BRRGHINTER
	CARGILL INC. CHEMICAL PRODUCTS DIV.	30050CRGLL71BAR
	CAROLINA SOLITE CORP.	28128CRLNSROUTE
	CHEVRON USA	19145CHVRN30THS
	CIBA-GEIGY CORP.	70776CBGGYRIVER
	CLINTON LABORATORIES	47842LLLLYSTATE
	CONTINENTAL CEMENT CO. INC.	63401CNTNNHIGHW
	COOK COMPOSITES & POLYMERS CO.	24531FRMNRPITTS
	DOW CHEMICAL CO. LA PORTE SITE	77572THDWCBATTL
	DOW CHEMICAL CO. LOUISIANA DIV.	70765THDWCHIGHW
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	DOW CHEMICAL USA MIDLAND SITE	48667THDWCMICHI
	DU PONT BEAUMONT PLANT	77704DPNTBSTATE
	DU PONT EDGE MOOR EDGE MOOR	19809DPNTD104HA
	DU PONT LA PORTE PLANT	77571DPNTL12501
	DU PONT SABINE RIVER WORKS	77631DPNTSFARMR
	EASTMAN KODAK CO. ELMGROVE PLANT	14653STMNK901EL
	EASTMAN KODAK CO. HAWK-EYE PLANT	14653STMNK20AVE
	EASTMAN KODAK CO. KODAK PARK	14652STMNK1669L
	EASTMAN KODAK CO. TENNESSEE DIV.	37662TNNSSEASTM
	ELI LILLY & CO. TIPPECANOE LABORATORIES	47905LLLLYLILLY
	FIRST CHEMICAL CORP.	39567FRSTC1001I

112(k) Source Category	Facility Name	TRI ID
	FMC CORP.	21226FMCCR1701E
	FMC CORP. BAYPORT PLANT	77507FMCCR12000
	GE CO. SILICONE PRODS.	12188GNRLL260HU
	GENCORP AEROJET PROPULSION DIV.	95670RJTGNAEROJ
	GEORGIA GULF CORP.	70765GRGGLHIGHW
	HERCULES INC.	23851HRCLSROUTE
	HERCULES INC. BACCHUS WORKS	84044HRCLS4950S
	HOECHST CELANESE CHEMICAL GROUP INC. BAYPORT T	77586HCHST11807
	HOLNAM INC. CLARKSVILLE PLANT	63336DNDCMPOBOX
	HOLNAM INC. HOLLY HILL PLANT	29059SNTCMSCHWY
	KENTUCKY SOLITE CORP.	40109KNTCKHIGHW
	LAFARGE CORP.	45879LFRGCCOUNT
	LAFARGE CORP.	49707LFRGCFORDA
	LONE STAR IND. INC.	63701LNSTR2524S
	LONE STAR INDUSTRIES	46135LNSTRPUTNA
	LUBRIZOL CORP.	44092THLBR29400
	LUBRIZOL PETROLEUM CHEMICALS CO.	44077LBRZL155FR
	MERCK & CO. INC. CHEROKEE SITE	17868MRCKC100AV
	MOBAY CORP.	26155MBYCRSTATE
	MOBAY CORP.	77520MBYCR8500W
	MOBAY CORP. AG CHEM. DIV.	64120MBYCR8400H
	MONSANTO CO.	52761MNSNTWIGGI
	NALCO CHEMICAL CO.	77487NLCCH7701U
	NEPERA INC.	10926NPRNCROUTE
	NISSAN MOTOR MFG. CORP. USA	37167NSSNMNISSA
	NORLITE CORP.	12047NRLTC628SO
	OCCIDENTAL CHEMICAL CORP. CORPUS CHRISTI PLANT	78359CCDNTHWY36
	OCCIDENTAL CHEMICAL CORP. DEER PARK SITE	77536CCDNT1000T
	OCCIDENTAL CHEMICAL CORP. NIAGARA PLANT	14302CCDNT4700B
	OLIN CORP. LAKE CHARLES PLANT	70602LNCRPI10WE
	OLIN CORP. LAKE CITY ARMY AMMUNITION PLANT	64051LKCTYINTER
	OLIN CORP. MAIN PLANT FACILITY	62024LNCRPSHAMR

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112(k) Source Category	Facility Name	TRI ID
	PHILLIPS RESEARCH CENTER	74004PHLLPPAWHU
	PPG IND. INC. COATINGS & RESINS	43113PPGNDPITTS
	QUANTUM CHEMICAL CO.	60450QNTMC8805N
	RADFORD ARMY AMMUNITION PLANT	24141RDFRDPOBOX
	SANDOZ AGRO INC.	77705SNDZCRT4BO
	SCHENECTADY CHEMICALS INC.	12150SCHNC1000M
	SHELL OIL CO. DEER PARK	77536SHLLLHIGHW
	SHELL OIL CO. MARTINEZ MFG. COMPLEX	94553SHLLL3485P
	SHELL OIL CO. NORCO MFG. COMPLEX - EAST	70079SHLLL1205R
	SMITHKLINE BEECHAM PHARMACEUTI CALS	19428SMTHK900RI
	SOLITE CORP.	23004SLTCRSTATE
	STERLING CHEMICALS INC.	77592STRLN201BA
	TEXACO CHEMICAL CO.	77301TXCCHJEFFE
	TEXACO CHEMICAL CO.	77651TXCCHHWY36
	TEXAS EASTMAN CO.	75607TXSSTOFFHI
	TEXAS IND. INC.	76065TXSND245WA
	UNION CARBIDE CORP. TEXAS CITY PLANT	77592NNCRB33015
	UNIROYAL CHEMICAL CO. INC.	70734NRYLCPOBOX
	VELSICOL CHEMICAL CORP.	38108VLSCL1100W
	VIRGINIA SOLITE CO.	24069VRGNSROUTE
	VULCAN CHEMICALS	67215VLCNC6200S
	VULCAN MATERIALS CO. CHEMICALS DIV.	70734VLCNMASHLA
	WESTINGHOUSE SAVANNAH RIVER CO.	29802SVNNHSCHIG
Inorganic Pigments Manufacturing		
	CP CHEMICALS INC.	29150CPCHMHWY15
	DRAKENFELD COLORS	15301DRKNFWESTW
	ENGELHARD CORP.	40212NGLHR3400B
	FERRO CORP.	44105FRRCR4150E
	FERRO CORP. COLOR DIV.	15204FRRCR60GRE
	JOHNSON MATTHEY INC.	19380JHNSN1401K
	SCM GLIDCO ORGANICS CORP.	21222SCMGL2701B
Inorganic Pigments: Cadmium Pigments in Plastics		

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112(k) Source Category	Facility Name	TRI ID
	GENERAL COLOR & CHEMICAL CO. INC.	44657GNRLCREAR6
	HOECHST-CELANESE CORP. SPECIALTY PRODS. FACILITY	41042HCHST8040D
	M. A. HANNA COLOR	41042PMSCN7915F
	PLASTICS COLOR-CHIP	60409PLSTC142EA
	PLASTICS COLOR-CHIP INC.	27203PLSTCHWY49
	PMS CONSOLIDATED	08873PMSCN109NE
	PMS CONSOLIDATED	28052PMSCN1801B
	PMS CONSOLIDATED	44857PMSCN80NOR
	PMS CONSOLIDATED	60007PMSCN2400E
	PMS CONSOLIDATED	63376PMSCN7GUEN
	PMS CONSOLIDATED	76140PMSCN9001S
	QUANTUM CHEMICAL CORP.	44077QNTMC303HI
	REED PLASTICS CORP. REED PLASTICS DIV.	01520RDPLSHOLDE
	REED PLASTICS CORP. REED PLASTICS DIV.	49224RDPLSALBIO
	TEKNOR APEX CO.	02861TKNRP505CE
	VISTA PERFORMANCE POLYMERS JEFFERSONTOWN PLA	40299PRMRP3001W
Mineral Wool Production		
	PARTEK INSULATION	36867PRTKN908SE
	ROCK WOOL MFG. CO.	35094RCKWLPARKW
Municipal Waste Combustors		
	CHRYSLER CORP. INDIANAPOLIS FNDRY.	46241CHRYS1100S
	COOS BAY LUMBER CO.	97459CSBYL250SA
	LANCASTER MALLEABLE CASTINGS CO.	17601LNCST1170L
	SPRINGFIELD WIRE INC.	01104SPRNG243CO
Nutritional Yeast Manufacturing		
	RED STAR YEAST	53208RDSTR325N2
	RED STAR YEAST & PRODS.	94607RDSTR13845
	RED STAR YEAST & PRODUCTS	21224RDSTRHOLAB
Other Cadmium Compound Production		
	AMERICAN MICROTRACE CORP.	68352GLPCHPOBOX
Petroleum Refineries: Other Sources Not Distinctly Listed		
	AMERADA HESS CORP. PORT READING	07064MRDHS750CL

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112(k) Source Category	Facility Name	TRI ID
	AMOCO CHEMICAL CO. TEXAS CITY PLANT A	77592MCCHMFOOTO
	AMOCO OIL CO.	84103MCLCM474WE
	AMOCO OIL CO. MANDAN REFINERY	58554MCLCMNORTH
	AMOCO OIL CO. WHITING REFINERY	46394MCLC 2815I
	ARCO CHERRY POINT REFINERY	98248RCCHR4519G
	ARCO PRODS. CO. LA REFINERY	90749RCPRD1801E
	ASHLAND PETROLEUM CO. CATLETTSBURG REFINERY	41114CTLTTPOBOX
	ATLAS PROCESSING CO.	71109TLSPR3333M
	BLOOMFIELD REFINING CO. INC.	87413BLMFLNO50C
	BP OIL CO. FERNDALE REFINERY	98248MBLLC3901U
	BP OIL CO. LIMA REFINERY	45804SHLCM1150S
	CALCASIEU REFINING CO.	70606CLCSRWESTE
	CANAL REFINING CO.	70525CNLRFHWY17
	CANTON REFINERY ASHLAND PETROELEUM CO.	44711SHLND2408G
	CENEX REFINERY	59044CNXRF803HI
	CHAMPLIN REFINING & CHEMICALS INC.	78409CHMPL7350I
	CHEVRON PRODS. CO.	08861CHVRN1200S
	CHEVRON PRODS. CO. RICHMOND BEACH ASPHALT REFY	98177PNTWL20500
	CHEVRON USA INC. EL PASO REFINERY	79905CHVRN6501T
	CHEVRON USA INC. PASCAGOULA REFINERY	39567CHVRNPOBOX
	CHEVRON USA INC. SALT LAKE REFINERY	84116CHVRN2351N
	CHEVRON USA PRODS. CO. EL SEGUNDO REFINERY	90245CHVRN324WE
	CHEVRON USA PRODS. CO. WILLBRIDGE ASPHALT REFIN	97210WLLBR5501N
	CHEVRON USA PRODUCTS CO. RICHMOND REFINERY	94802CHVRN841ST
	CITGO ASPHALT REFINING CO.	31408MCLCMFOUND
	CITGO PETROLEUM CORP. LAKE CHARLES OPS.	70602CTGPTHIGHW
	CLARK OIL & REFINING CORP. BLUE ISLAND	60406CLRKL13100
	CLARK OIL & REFINING CORP. WOOD RIVE	62048CLRKLHAWTH
	COASTAL EAGLE POINT OIL CO.	08093CSTLGRTES1
	COASTAL REFINING & MARKETING INC.	78403CSTLR1300C
	CONOCO BILLINGS REFINERY	59101CNCBL401SO
	CONOCO DENVER REFY.	80022CNCDN5801B

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112(k) Source Category	Facility Name	TRI ID
	CONOCO LAKE CHARLES REFY.	70669CNCLKOLDSP
	CONOCO PONCA CITY REFINERY	74603CNCPN1000S
	CONOCO SANTA MARIA REFINERY	93454CNCSN1660S
	CROWN CENTRAL PETROLEUM CORP. HOUSTON REFY.	77506CRWNC111RE
	CRYSEN REFINING INC.	84087CRYSN2355S
	EXXON BAYTOWN REFY.	77522XXNBY2800D
	EXXON BILLINGS REFINERY	59101XXNBL700EX
	EXXON CO. USA BATON ROUGE REFY.	70805XXNBT4050S
	EXXON CO. USA BENICIA REFINERY	94510XXNCS3400E
	FARMLAND IND. INC.	67337FRMLNNORTH
	FINA OIL & CHEMICAL CO.	77640FNLNDHIGHW
	FINA OIL & CHEMICAL CO.	79721FNLNDIS20E
	FRONTIER REFINING INC.	82007FRNTR2700E
	GIANT REFINING CO. CINIZA	87301GNTRFROUTE
	HAWAIIAN INDEPENDENT REFINERY INC.	96707HWNND91325
	HOWELL HYDROCARBONS INC.	78223HWLLH7811S
	HUNT REFINING CO.	35401HNTRF1855F
	HUNTWAY REFINING CO.	90744HNTWY1651A
	HUNTWAY REFINING CO.	94510HNTWY3001P
	KERN OIL & REFINING CO.	93307KRNLRRR677
	KERR-MCGEE REFINING CORP.	71018KRRMCLA7SO
	KOCH REFINING CO.	55164KCHRFPOBOX
	KOCH REFINING CO. L.P. WEST FACILITY	78410KCHRFSUNTI
	LA GLORIA OIL & GAS CO.	75702LGLRL1702E
	LAKETON REFINING CORP.	46943LKTNROGDEN
	LION OIL CO.	71730LNLRF1000M
	LITTLE AMERICA REFINING CO.	82609LTTLM5700E
	LL & E PETROLEUM MTG. INC.	36571LLPTRINDUS
	LYONDELL PETROCHEMICAL CO. HOUSTON REFINERY	77017LYNDL12000
	MAPCO ALASKA PETROLEUM INC.	99705MPCLS1100H
	MAPCO PETROLEUM INC.	38109MPCPT543WE
	MARATHON OIL CO.	48217MRTHN1300S

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112(k) Source Category	Facility Name	TRI ID
	MARATHON OIL CO.	62454MRTHNRR1
	MARATHON OIL CO. LOUISIANA REFINING DIV.	70051MRTHNHWY61
	MARATHON PETROLEUM CO.	77590MRTHNFOOTO
	MOBIL JOLIET REFINING CORP.	60434MBLJLINTER
	MOBIL OIL BEAUMONT REFINERY	77701BMNTREASTE
	MOBIL OIL CORP.	70143TNNCL500WE
	MOBIL OIL CORP. TORRANCE REFINERY	90509MBLLC3700W
	MOBIL OIL PAULSBORO REFY.	08066MBLLCBILLI
	MONTANA REFINING CO.	59414MNTNR19001
	MURPHY OIL USA INC.	54880MRPHY24THA
	MURPHY OIL USA INC. MERAUX REFINERY	70075MRPHY2500E
	NAVAJO REFINING CO.	88210NVJRF501EA
	PARAMOUNT PETROLEUM CORP.	90723PRMNT14700
	PENNZOIL PRODS. CO. ROUSEVILLE REFY.	16344PNNZL2MAIN
	PHIBRO REFINERY KROTZ SPRINGS REFINERY	70750HLLPTHWY10
	PHIBRO REFINING INC.	77012HLLPT9701M
	PHIBRO REFINING INC.	77592TXSCTLOOP1
	PHILLIPS 66 CO.	77480PHLLPSH35A
	PHILLIPS 66 CO.	79008PHLLPSTATE
	PHILLIPS 66 CO.	84087PHLLP393SO
	PLACID REFINING CO.	70767PLCDR1940L
	PRIDE REFINING INC.	79604RDRFNNORTH
	QUAKER STATE CORP. CONGO PLANT	26050QKRSTRT2
	SEAVIEW OIL CO.	08066SVWLC4PARA
	SHELL OIL CO. ANACORTES REFINERY	98221SHLLLWESTM
	SHELL OIL CO. MARTINEZ MFG. COMPLEX	94553SHLLL3485P
	SHELL OIL CO. NORCO CHEMICAL PLANT	70079SHLLL265RI
	SHELL OIL CO. ODESSA REFINERY	79760SHLLLSOUTH
	SINCLAIR OIL CORP. TULSA REFINERY	74107SNCLR902W2
	SINCLAIR OIL CORP.- SINCLAIR WYOMING REFY.	82334SNCLREASTL
	SOUTHLAND OIL CO.	39455STHLNHIGHW
	SOUTHLAND OIL CO. SANDERSVILLE	39477STHLNHIGHW

112(k) Source Category	Facility Name	TRI ID
	STAR ENTERPRISE	19706TXCDL2000W
	STAR ENTERPRISE	70723TXCRFFOOTO
	SUN REFINING & MARKETING CO.	19061SNRFNGREEN
	SUN REFINING & MARKETING CO.	74107SNRFN1700S
	SUNLAND REFINING CORP.	93302SNLND2152C
	TESORO ALASKA PETROLEUM CO.	99611TSRLSMILE2
	TEXACO REFINING & MARKETING INC.	67042TXCRF1401S
	TEXACO REFINING & MARKETING INC.	93308TXCRF6451R
	TEXACO REFINING & MARKETING INC. PUGET SOUND PL	98221PGTSN600ST
	THREE RIVERS REFY.	78071DMNDS301LE
	TOSCO REFINING CO.	94553TSCCRAVONR
	TOTAL PETROLEUM INC.	73401TTLPTHIGHW
	TOTAL PETROLEUM INC. ALMA REFINERY	48802TTLPTESUPE
	TRMI LOS ANGELES REFINERY	90744TXCRF2101E
	ULTRAMAR INC.	90748NNPCF2402E
	UNITED REFINING CO.	16365NTDRFPOBOX
	UNO-VEN CO. CHICAGO REFINERY	60439NCLCR135TH
	UNOCAL LOS ANGELES REFINERY WILMINGTON PLANT	90748NCLLS1660W
	VALERO REFINING CO.	78469VLRRF5900U
	WITCO CORP. BRADFORD OPERATIONS	16701KNDLL77NKE
	YOUNG REFINING CORP.	30134YNGRF7982H
Phthalic Anhydride Production		
	KOPPERS IND. INC.	60650KPPRS3900S
Polycarbonates Production		
	DOW CHEMICAL CO. TEXAS OPERATIONS	77541THDWCBUILD
	GE CO. PLASTICS	47620GPLSTLEXAN
	GE CO. PLASTICS BURKVILLE OPERATION	36752GPLSTONEPL
	MOBAY CORP.	77520MBYCR8500W
Polymers & Resins III		
	3M CHEMOLITE CENTER	55016MCHMLHIGHW
	3M CORDOVA PLANT	61242M 22614
	AKZO COATINGS INC.	40209RLNCN4730C

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112(k) Source Category	Facility Name	TRI ID
	ALLIED-SIGNAL INC. BRAKING SYS.	12183LLDSGTIBBE
	AMERICAN CYANAMID CO.	49003MRCNC2715M
	AMETEK INC. HAVEG DIV.	19808MTKNC900GR
	ASHLAND CHEMICAL CO.	44102SHLND2191W
	ASHLAND CHEMICAL INC.	60409SHLND142ND
	AURALUX CORP.	06360RLXCR29STO
	BORDEN CHEMICAL	98032BRDNN421FI
	BORDEN INC. ADHESIVES & RESINS	59802BRDNN3670G
	BORDEN INC. PACKAGING & INDL. PRODS.	75941BRDNN100WE
	BORDEN PACKAGING & IND. PRODUCTS	94538BRDNN41100
	BORDEN PACKAGING & INDL. PRODS.	36732BRDNNLOCKD
	BORDEN PACKAGING & INDL. PRODS.	40216BRDNN6200C
	BORDEN PACKAGING & INDL. PRODS.	53081BRDNN2522S
	BORDEN PACKAGING & INDS. PRODS	97477BRDNN470SO
	BORDEN PACKAGING & INDUSTRIAL PRODUCTS	28302BRDNN1411I
	BORDEN PACKAGING & INDUSTRIAL PRODUCTS	60130BRDNN1401C
	BORDEN PACKAGING & INDUSTRIAL PRODUCTS	71302BRDNN3901S
	BTL SPECIALTY RESINS CORP.	43606BTLSP2112S
	BTL SPECIALTY RESINS CORP.	72104BTLSPRT3GI
	CAPITAL RESIN CORP.	43207CPTLR324DE
	CARGILL INC. CHEMICAL PRODUCTS DIV.	30050CRGLL71BAR
	CARGILL INC. LYNWOOD	90262CRGLL2801L
	CL INDUSTRIES INC.	61846CLNDSMAPLE
	COOK COMPOSITES & POLYMERS CO.	64116CKPNT919EA
	CYTEC IND.	06492MRCNCSOUTH
	DEGUSSA CORP.	36590DGSSCDEGUS
	DELTA RESINS & REFRACTORIES	53209DLTRS6263N
	DELTA RESINS & REFRACTORIES INC.	48212DLTRS17350
	DEXTER CORP. MIDLAND DIV.	60085MDLND17EWA
	DEXTER CORP. PACKAGING PRODS. DIV.	35215MDLND90CAR
	DOCK RESINS CORP.	07036DCKRS1512W
	DU PONT WASHINGTON WORKS	26180DPNTWDUPON

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	DYNO POLYMERS INC.	97503RVPCR1405A
	GEORGIA-PACIFIC CORP. RESINS DIV.	39168GRGPCHIGHW
	GEORGIA-PACIFIC CORP. RESINS PLANT	39339GRGPCARMST
	GEORGIA-PACIFIC CORP. VIENNA PARTICLEBOARD	31092GRGPCHIGHW
	GEORGIA-PACIFIC RESINS INC.	27820GRGPCAMPAC
	GEORGIA-PACIFIC RESINS INC.	29476GRGPCPOBOX
	GEORGIA-PACIFIC RESINS INC.	30269GRGPC411DI
	GEORGIA-PACIFIC RESINS INC.	31407GRGPCCROSS
	GEORGIA-PACIFIC RESINS INC.	43207GRGPC1975W
	GEORGIA-PACIFIC RESINS INC.	49738GRGPCROUTE
	GEORGIA-PACIFIC RESINS INC.	75901GRGPC1429E
	GEORGIA-PACIFIC RESINS INC.	95482GRGPC2163N
	GEORGIA-PACIFIC RESINS INC.	95624GRGPC10399
	GEORGIA-PACIFIC RESINS INC.	97321GRGPC2190O
	GEORGIA-PACIFIC RESINS INC.	97402GRGPC2665H
	HERCULES INC.	01013HRCLS1111G
	HERCULES INC.	39401HRCLSWEST7
	HERCULES INC.	53209HRCLS5228N
	HERCULES INC. PORTLAND PLANT	97210HRCLS3366N
	HERCULES INC. SPECIALTY CHEMICALS DIV.	31401HRCLSOLDLO
	HOECHST CELANESE CORP.	78343HCHSTHWY77
	HOECHST CELANESE CORP. SOU-TEX	28120HCHSTPOBOX
	INDSPEC CHEMICAL CORP.	16050KPPRSMAINS
	LAWTER INTL.INC. SOUTHERN RESINS DIV.	35474LWTRNCRACK
	LEO COOK CO.	99216LCKC BLDG3
	MONSANTO CO.	45001MNSNTRIVER
	MONSANTO CO. INDIAN ORCHARD MA	01151MNSNT730WO
	NESTE RESINS CORP.	27559CHMBNSTATE
	NESTE RESINS CORP.	36476CHMBNHIGHW
	NESTE RESINS CORP.	43612CHMBN6175A
	NESTE RESINS CORP.	71483CHMBNHIGHW
	NESTE RESINS CORP.	97477CHMBN475NO

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	OCCIDENTAL CHEMICAL CORP.	43326CCDNT13717
	OCCIDENTAL CHEMICAL CORP. DUREZ DIV.	14304BTLSP5000P
	P. D. GEORGE CO.	63147PDGRG5200N
	PERSTORP COMPOUNDS INC.	01060PRSTR238NO
	PIONEER PLASTICS CORP.	04210STRLNPIONI
	PLASTICS ENG. CO.	53083PLSTC2732N
	PLASTICS MANUFACTURING CO.	75224PLSTC2700S
	PMC SPECIALTIES INC.	08863PMCSPINDUS
	PPG IND. INC. (OAK CREEK)	53154PPGND10800
	PPG IND. INC. COATINGS & RESINS	43113PPGNDPITTS
	REICHHOLD CHEMICALS INC.	07105SPNCR400DO
	SCHENECTADY CHEMICALS INC.	12150SCHNC1000M
	SCHENECTADY INTL. INC.	12303SCHNC10THA
	SEQUA CHEMICALS INC.	29706SQCHMONESE
	SIMPSON TIMBER CO. OREGON OVERLAY DIV.	97217RGNVR2301N
	SOUTHEASTERN ADHESIVES CO.	24148STHSTSTATE
	SOUTHEASTERN ADHESIVES CO.	28645STHST815DV
	SPAULDING COMPOSITES SPECIALTY PLASTIC DIV.	60115SPLDN1300S
	SPURLOCK ADHESIVES INC.	23890SPRLCRT460
	SYBRON CHEMICALS INC.	29385SYBRN10150
	SYNTHRON INC.	28655SYNTHAMHER
	VALSPAR CORP.	60901THVLS901NO
	VALSPAR CORP.	75042DSTNC701SH
	WESTINGHOUSE ELECTRIC CORP.	15665WSTNGROUTE
	WESTINGHOUSE ELECTRIC CORP.	29924WSTNGPOBOX
Polystyrene Production		
	A & E PLASTICS	91746PLSTC14505
	AMERICAN POLYMERS INC.	01540MRCNPOLDWE
	AMERICAN POLYSTYRENE CORP.	90502MCCHM1225W
	AMOCO CHEMICAL CO. JOLIET PLANT	60434MCCHM12MIL
	AMOCO CHEMICAL CO. WILLOW SPRINGS PLANT	60480MCCHM8400W
	ARCO CHEMICAL CO.	15061RCCHMFRANK

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	ARCO CHEMICAL CO.	44077RCPLS786HA
	CHEVRON CHEMICAL CO.	45750CHVRNROUTE
	DART POLYMERS INC.	42301DRTPL2400H
	DOW CHEMICAL CO. HANGING ROCK PLANT	45638DWCHMOLDHI
	DOW CHEMICAL CO. TORRANCE CA.	90503DWCHM305CR
	DOW CHEMICAL USA MIDLAND SITE	48667THDWCMICHI
	DOW NORTH AMERICA ALLYN'S POINT PLANT	06335DWCHMROUTE
	DOW NORTH AMERICA RIVERSIDE PLANT	63070DWCHMDOWIN
	FINA OIL & CHEMICAL CO.	60409FNLND14200
	FINA OIL & CHEMICAL CO. POLYSTYRENE PLANT	70721FNLCHLAHWY
	GE CO. PLASTICS	12158GNRLLNORYL
	HUNTSMAN CHEMICAL CORP.	23320HNTSM5100B
	HUNTSMAN CHEMICAL CORP.	30161HNTSM6RIVE
	HUNTSMAN CHEMICAL CORP.	45714HNTSMTOWNS
	HUNTSMAN CHEMICAL CORP. PERU PLANT	61354HNTSM501BR
	KAMA CORP.	18201KNTPL666DI
	MOBIL CHEMICAL CO.	01040MBLCH3HANO
	MOBIL CHEMICAL CO. SANTA ANA PLANT	92707MBLCH2530S
	MOBIL JOLIET REFINING CORP.	60434MBLJLINTER
	MONSANTO CO.	45001MNSNTRIVER
	NOVACOR CHEMICALS INC. PLASTICS DIV.	44321PLYSR1122J
	NOVACOR INC. PLASTICS DIV.	01453PLYSR29FUL
	POLYSAR INC.	35602PLYSRPOBOX
	POLYSAR INC. NOVACOR CHEMICALS	01151PLYSR950WO
Primary Copper Smelting		
	ASARCO INC. EL PASO	79999SRCNCPOBOX
	ASARCO INC. RAY COMPLEX/HAYDEN SMELTER	85235SRCNC64ASA
	KENNECOTT UTAH COPPER	84006KNNCT8362W
	MAGMA COPPER CO. SAN MANUEL DIV.	85631MGMCPHIGHW
Pulp and Paper Production (combustion) MACT II		
	ALABAMA RIVER PULP CO. INC.	36470LBMRVOFFHI
	APPLETON PAPERS INC.	16673PPLTN100PA

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	ASHDOWN MILL	71822NKSPPHIGHW
	BADGER PAPER MILLS INC.	54157BDGRP200WE
	BOISE CASCADE CORP.	56649BSCSCSECON
	BOISE CASCADE CORP.	70634BSSTHUSHIG
	BOISE CASCADE CORP.	97051BSCSC1300K
	BOISE CASCADE CORP. WHITE PAPER DIV.	04276BSCSCROUTE
	BOISE CASCADE CORP. WHITE PAPER DIV.	36545BSCSC307WE
	BOISE CASCADE PAPER DIV.	99363BSCSCPOBOX
	BOWATER INC. COATED PAPER & PULP DIV.	29704BWTRC5300C
	BOWATER SOUTHERN PAPER CO. SOUTHERN DIV.	37309BWTRSROUTE
	BOWATER/GREAT NORTHERN PAPER INC.	04462GRTNR1KATA
	CHAMPION INTERNATIONAL CORP. LUFKIN NEWSPRINT	75902CHMPNHIGHW
	CHAMPION INTL. CORP.	28716CHMPNMAINS
	CHAMPION INTL. CORP.	32533CHMPN375MU
	CHAMPION INTL. CORP.	49876CHMPNUSHIG
	CHAMPION INTL. CORP.	77044CHMPN11611
	CHAMPION INTL. CORP. COURTLAND MILL	35618CHMPNPOBOX
	CHESAPEAKE PAPER PRODS. CO.	23181CHSPK19THM
	COLUMBUS PULP & PAPER COMPLEX	39703CLMBSCARSO
	CONTAINER CORP. OF AMERICA	36426CNTNRHIGHW
	CPI KRAFT DIV.	54494CNSLD950FO
	FEDERAL PAPER BOARD CO. INC.	28456FDRLPRIEGE
	FEDERAL PAPER BOARD CO. INC. AUGUSTA OPERATIONS	30913FDRLPHIGHW
	GEORGIA-PACIFIC CORP.	04694GRGPCMILLA
	GEORGIA-PACIFIC CORP.	32078GRGPCSTATE
	GEORGIA-PACIFIC CORP. BRUNSWICK OPS.	31520BRNSWWEST9
	GEORGIA-PACIFIC CORP. PAPER OPERATIONS	71635GRGPCPAPER
	GEORGIA-PACIFIC CORP. PORT EDWARDS MILL	54469PRTDW100WI
	GEORGIA-PACIFIC CORP. PORT HUDSON	70791GRGPCZACHA
	GEORGIA-PACIFIC WEST CORP. TOLEDO PULP & PAPER O	97391GRGPCBUTLE
	GILMAN PAPER CO.	31558GLMNP1000O
	GULF STATES PAPER CORP.	36732GLFSTHIGHW

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	INLAND-ROME INC.	30162NLNDR238MA
	INTERNATIONAL PAPER	04239NTRNTRILEY
	INTERNATIONAL PAPER	12883NTRNTSHORE
	INTERNATIONAL PAPER CO. LOUISIANA MILL	71220NTRNT705CO
	INTERNATIONAL PAPER CO. PINE BLUFF MILL	71611NTRNTFAIRF
	INTERNATIONAL PAPER GEORGETOWN MILL	29442NTRNTKAMIN
	INTERNATIONAL PAPER HAMMERMILL RIVERDALE MILL	36701HMMRMRIVER
	INTERNATIONAL PAPER MOSS POINT MILL	39563NTRNT2019G
	INTERNATIONAL PAPER TEXARKANA MILL	75504NTRNTPOBOX
	INTL. PAPER NATCHEZ MILL	39120NTRNT312LO
	ITT RAYONIER INC. JESUP PULP DIV.	31545TTRYNSAVAN
	ITT RAYONIER INC. PORT ANGELES DIV.	98362TTRYN700NO
	JAMES RIVER CORP. NAHEOLA MILL	36916JMSRVROUTE
	JAMES RIVER CORP. OLD TOWN MILL	04468JMSRVPORTL
	JAMES RIVER II INC.	97016JMSRVWAUNA
	JAMES RIVER PAPER CO. CAMAS MILL	98607JMSRVNE4TH
	JAMES RIVER PAPER CO. INC.	70775JMSRVENDOF
	JAMES RIVER U.S. HOLDINGS INC.	03570JMSRV650MA
	KETCHIKAN PULP CO.	99901KTCHKMILE7
	LINCOLN PULP & PAPER CO. INC.	04457LNCLNKATAH
	LONGVIEW FIBRE CO.	98632LNGVWSOUTH
	LOUISIANA-PACIFIC CORP. SAMOA PULP MILL	95564LSNPCLPDRI
	MANVILLE FOREST PRODUCTS CORP. PLANT #31	71292MNVLL1031J
	MEAD FINE PAPER DIV.	45601MDCRP401SP
	MEAD PUBLISHING PAPER DIV.	49829MDPBLCOUNT
	MOSINEE PAPER CORP.	54455MSNPP100MA
	NEKOOSA PAPERS INC. NEKOOSA MILL	54457NKSMLMARKE
	P. H. GLATFELTER CO.	17362PHGLT228SO
	PACKAGING CORP. OF AMERICA TOMAHAWK MILL	54487NKSPCN9090
	POPE & TALBOT INC. HALSEY PULP MILL	97348PPTLB30480
	POTLATCH CORP.	71654PTLTCHIGHW
	POTLATCH CORP. IDAHO PULP & PAPERBOARD DIV.	83501PTLTC805MI

112(k) Source Category	Facility Name	TRI ID
	POTLATCH CORP. N.W. PAPER DIV.	55720PTLTCNORTH
	PROCTER & GAMBLE CELLULOSE CO.	32347BCKYCROUTE
	S. D. WARREN CO.	04092SDWRR89CUM
	S. D. WARREN CO.	49443SDWRR2400L
	SCOTT PAPER CO.	36652SCTTPBAYBR
	SCOTT PAPER CO.	98201SCTTP2600F
	SIMPSON PASADENA PAPER CO.	77506SMPSNNORTH
	SIMPSON TACOMA KRAFT CO.	98421SMPSN801PO
	SONOCO PRODS. CO.	29550SNCPRNORTH
	ST. JOE FOREST PRODS. CO.	32456STJFRUSHIG
	STONE CONTAINER CORP.	59806STNCNMULLA
	STONE CONTAINER CORP. PANAMA CITY MILL	32401STNCN1EVER
	STONE SOUTHWEST CORP.	85937STNST277SP
	TEMPLE-INLAND FPC BLEACHED PAPERBOARD	77656PLPPPPOBOX
	THILMANY	54130THLMNTHILM
	U.S. PULP & NEWSPRINT	35044SPLPNALABA
	UNION CAMP CORP.	31402NNCMPWESTL
	UNION CAMP CORP. FINE PAPER & BUILDING PRODS.	23851NNCMPHIGHW
	WAUSAU PAPERS	54417WSPPR2NDST
	WESTVACO CORP. BLEACHED BOARD DIV.	24426WSTVCRIVER
	WESTVACO CORP. CHEMICAL DIV.	24426WSTVCWASHI
	WESTVACO CORP. FINE PAPERS DIV.	21540WSTVC300PR
	WESTVACO CORP. FINE PAPERS DIV.	42087WSTVCHIGHW
	WESTVACO CORP. KRAFT DIV.	29411WSTVC5600A
	WEYERHAEUSER CO.	97478WYRHS785N4
	WEYERHAEUSER CO.	98537WYRHS700EA
	WEYERHAEUSER CO.	98632WYRHS3401I
	WEYERHAEUSER CO. PLYMOUTH MILL	27962WYRHSTROWB
	WEYERHAEUSER PAPER CO.	28560WYRHSSTREE
	WILLAMETTE INDUSTRIES INC. KENTUCKY MILLS	42348WLLMTPOBOX
	WILLAMETTE INDUSTRIES PENNTECH MILL	15845PNNTC100CE

Pulp and Paper Production (non-combustion) MACT I

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	ALABAMA RIVER PULP CO. INC.	36470LBMRVOFFHI
	APPLETON PAPERS INC.	16673PPLTN100PA
	ASHDOWN MILL	71822NKSPPHIGHW
	BADGER PAPER MILLS INC.	54157BDGRP200WE
	BOISE CASCADE CORP.	56649BSCSCSECON
	BOISE CASCADE CORP. WHITE PAPER DIV.	04276BSCSCROUTE
	BOISE CASCADE CORP. WHITE PAPER DIV.	36545BSCSC307WE
	BOISE CASCADE PAPER DIV.	99363BSCSCPOBOX
	BOWATER INC. COATED PAPER & PULP DIV.	29704BWTRC5300C
	BOWATER SOUTHERN PAPER CO. SOUTHERN DIV.	37309BWTRSROUTE
	BOWATER/GREAT NORTHERN PAPER INC.	04462GRTNR1KATA
	CHAMPION INTERNATIONAL CORP. LUFKIN NEWSPRINT	75902CHMPNHIGHW
	CHAMPION INTL. CORP.	28716CHMPNMAINS
	CHAMPION INTL. CORP.	32533CHMPN375MU
	CHAMPION INTL. CORP. COURTLAND MILL	35618CHMPNPOBOX
	CHESAPEAKE PAPER PRODS. CO.	23181CHSPK19THM
	COLUMBUS PULP & PAPER COMPLEX	39703CLMBSCARSO
	CONTAINER CORP. OF AMERICA	36426CNTNRHIGHW
	CPI KRAFT DIV.	54494CNSLD950FO
	FEDERAL PAPER BOARD CO. INC.	28456FDRLPRIEGE
	FEDERAL PAPER BOARD CO. INC. AUGUSTA OPERATIONS	30913FDRLPHIGHW
	FLAMBEAU PAPER CORP.	54552FLMBP200NO
	GEORGIA-PACIFIC CORP.	04694GRGPCMILLA
	GEORGIA-PACIFIC CORP.	32078GRGPCSTATE
	GEORGIA-PACIFIC CORP. BELLINGHAM DIV.	98225GRGPC300WL
	GEORGIA-PACIFIC CORP. BRUNSWICK OPS.	31520BRNSWWEST9
	GEORGIA-PACIFIC CORP. PAPER OPERATIONS	71635GRGPCPAPER
	GEORGIA-PACIFIC CORP. PORT EDWARDS MILL	54469PRTDW100WI
	GEORGIA-PACIFIC WEST CORP. TOLEDO PULP & PAPER O	97391GRGPCBUTLE
	GULF STATES PAPER CORP.	36732GLFSTHIGHW
	INLAND-ROME INC.	30162NLNDR238MA
	INTERNATIONAL PAPER	04239NTRNTRILEY

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	INTERNATIONAL PAPER	12883NTRNTSHORE
	INTERNATIONAL PAPER CO. LOUISIANA MILL	71220NTRNT705CO
	INTERNATIONAL PAPER CO. PINE BLUFF MILL	71611NTRNTFAIRF
	INTERNATIONAL PAPER ERIE MILL	16533HMMRM1540E
	INTERNATIONAL PAPER GEORGETOWN MILL	29442NTRNTKAMIN
	INTERNATIONAL PAPER HAMMERMILL RIVERDALE MILL	36701HMMRMRIVER
	INTERNATIONAL PAPER MOSS POINT MILL	39563NTRNT2019G
	INTERNATIONAL PAPER TEXARKANA MILL	75504NTRNTPOBOX
	INTL. PAPER NATCHEZ MILL	39120NTRNT312LO
	ITT RAYONIER INC. JESUP PULP DIV.	31545TTRYNSAVAN
	ITT RAYONIER INC. PORT ANGELES DIV.	98362TTRYN700NO
	JAMES RIVER CORP. NAHEOLA MILL	36916JMSRVROUTE
	JAMES RIVER CORP. OLD TOWN MILL	04468JMSRVPORTL
	JAMES RIVER II INC.	97016JMSRVWAUNA
	JAMES RIVER PAPER CO. CAMAS MILL	98607JMSRVNE4TH
	JAMES RIVER U.S. HOLDINGS INC.	03570JMSRV650MA
	KETCHIKAN PULP CO.	99901KTCHKMILE7
	LINCOLN PULP & PAPER CO. INC.	04457LNCLNKATAH
	LONGVIEW FIBRE CO.	98632LNGVWSOUTH
	LOUISIANA-PACIFIC CORP. SAMOA PULP MILL	95564LSNPCLPDRI
	MANVILLE FOREST PRODUCTS CORP. PLANT #31	71292MNVLL1031J
	MEAD FINE PAPER DIV.	45601MDCRP401SP
	MEAD PUBLISHING PAPER DIV.	49829MDPBLCOUNT
	MOSINEE PAPER CORP.	54455MSNPP100MA
	NEKOOSA PAPERS INC. NEKOOSA MILL	54457NKSMLMARKE
	P. H. GLATFELTER CO.	17362PHGLT228SO
	PACKAGING CORP. OF AMERICA TOMAHAWK MILL	54487NKSPCN9090
	POPE & TALBOT INC. HALSEY PULP MILL	97348PPTLB30480
	POTLATCH CORP.	71654PTLTCHIGHW
	POTLATCH CORP. IDAHO PULP & PAPERBOARD DIV.	83501PTLTC805MI
	POTLATCH CORP. N.W. PAPER DIV.	55720PTLTCNORTH
	PROCTER & GAMBLE CELLULOSE CO.	32347BCKYCROUTE

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	PROCTER & GAMBLE PAPER PRODS. CO.	18629PRCTRROUTE
	RAYONIER INC. FERNANDINA PULP DIV.	32034TTRYNFOOTO
	S. D. WARREN CO.	04092SDWRR89CUM
	S. D. WARREN CO.	49443SDWRR2400L
	SCOTT PAPER CO.	36652SCTTPBAYBR
	SCOTT PAPER CO.	98201SCTTP2600F
	SIMPSON PAPER CO.	96007SMPSNHAWES
	SIMPSON PASADENA PAPER CO.	77506SMPSNNORTH
	SIMPSON TACOMA KRAFT CO.	98421SMPSN801PO
	SONOCO PRODS. CO.	29550SNCPRNORTH
	STONE CONTAINER CORP.	59806STNCNMULLA
	STONE CONTAINER CORP. PANAMA CITY MILL	32401STNCN1EVER
	STONE SOUTHWEST CORP.	85937STNST277SP
	TEMPLE-INLAND FPC BLEACHED PAPERBOARD	77656PLPPPPOBOX
	THILMANY	54130THLMNTHILM
	U.S. PULP & NEWSPRINT	35044SPLPNALABA
	UNION CAMP CORP.	31402NNCMPWESTL
	UNION CAMP CORP. FINE PAPER & BUILDING PRODS.	23851NNCMPHIGHW
	WAUSAU PAPERS	54417WSPPR2NDST
	WESTVACO CORP. BLEACHED BOARD DIV.	24426WSTVCRIVER
	WESTVACO CORP. FINE PAPERS DIV.	21540WSTVC300PR
	WEYERHAEUSER CO.	97478WYRHS785N4
	WEYERHAEUSER CO.	98537WYRHS700EA
	WEYERHAEUSER CO.	98632WYRHS3401I
	WEYERHAEUSER CO. PLYMOUTH MILL	27962WYRHSTROWB
	WEYERHAEUSER PAPER CO.	28560WYRHSSTREE
	WEYERHAEUSER PAPER CO.	54474WYRHS200GR
	WILLAMETTE INDS. INC. KINGSPORT MILL	37662MDPPRPOBOX
	WILLAMETTE INDUSTRIES INC. KENTUCKY MILLS	42348WLLMTPOBOX
	WILLAMETTE INDUSTRIES PENNTECH MILL	15845PNNTC100CE
Refractories Manufacturing		
	A. P. GREEN IND. INC.	45656PGRNRCOUNT

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112(k) Source Category	Facility Name	TRI ID
	BMI-FRANCE	45682BMRFRPOTTS
	DIDIER TAYLOR REFRACTORIES CORP.	45244DDRTY8361B
	DRESSER INDUSTRIES INC. HARBISON-WALKER REFRACT	63382HRBSNBOOKE
	FOSECO INC. CLEVELAND FACILITY	44142FSCNC20200
	GENERAL REFRACTORIES CO. LEHI WORKS	84043GNRLR2200N
	HARBISON-WALKER REFRACTORIES	65251HRBSN1301W
	HARBISON-WALKER REFRACTORIES DRESSER INDUSTRIE	46323HRBSN5501K
	MARTIN MARIETTA MAGNESIA SPECIALTIES INC.	48218MRTNM160SA
	MINTEQ INTL. INC. ZEDMARK DIV.	16057QGLYCRD3
	MISSOURI REFRACTORIES CO. INC.	63119MSSRR24ALL
	NATIONAL REFRACTORIES & MINERALS CORP.	44408NTNLR41738
	NATIONAL REFRACTORIES & MINERALS CORP.	65265NTNLRPOBOX
	NATIONAL REFRACTORIES & MINERALS CORP.	95039NTNLRHIGHW
	NORTH AMERICAN REFRACTORIES CO.	19567NRTHMROUTE
	NORTH AMERICAN REFRACTORIES CO.	49349NRTHMM378T
	NORTH AMERICAN REFRACTORIES CO.	63345NRTHM300WL
	QUIGLEY CO. INC.	08857QGLYCBORDE
	REFRACTORY SALES & SERVICE CO. INC.	35023RFRCT1750H
	RENO & SON REFRACTORY	35116RNSNR610BA
	RIVERSIDE REFRACTORIES INC.	35125RVRSDTRUSS
	UNITED REFRACTORIES INC.	44483NTDRF1929L
	WELLSVILLE FIRE BRICK CO.	63384WLLSVWESTH
	ZIRCOA INC.	44139ZRCNC31501
Secondary Lead Smelting		
	EAST PENN MFG. CO. INC. INC.	19536STPNNDEKAR
	EXIDE CORP. GENERAL BATTERY	46302XDCRP2601W
	GENERAL SMELTING & REFINING INC.	37046GNRLSHIGHW
	GNB INC. RESOURCE RECYCLING DIV.	31901GNBNCJOYRO
	GNB INC. RESOURCE RECYCLING DIV.	75034GNBNCSOUTH
	GNB TECH. INC.	90058GNBNC2717S
	GOPHER SMELTING & REFINING CO.	55121GPHRS3385S
	GULF COAST RECYCLING INC.	33619GLFCS1901N

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112(k) Source Category	Facility Name	TRI ID
	MASTER METALS INC.	44113MSTRM2850W
	QUEMETCO INC.	46231QMTCN7870W
	QUEMETCO INC.	91745QMTCN720SO
	REFINED METALS CORP.	38109RFNDM257WE
	REFINED METALS CORP.	46203RFNDM3700S
	ROSS METALS INC.	38066RSSMT100NR
	SANDERS LEAD CO. INC.	36081SNDRSHENDE
	SCHUYLKILL METALS CORP.	64451SCHYLRRIII
	SCHUYLKILL METALS CORP.	70874SCHYLWESTE
Secondary Mercury Production		
	BETHLEHEM APPARATUS CO. INC.	18055BTHLH890FR
Secondary Zinc Production		
	FLORIDA STEEL CORP.	38305FLRDSUSHIG
	INDIANA STEEL & WIRE CO.	47303NDNST2200E
	W. J. BULLOCK INC.	35224WJBLL1501E
Spandex Production		
	GLOBE MFG. CO.	28053GLBMN3145N
Tire Production		
	BRIDGESTONE/FIRESTONE INC.	62526FRSTN2500N
	COOPER TIRE & RUBBER CO. ENGINEERED PRODUCTS DI	46706CPRND725W1
	COOPER TIRE CO.	38802CPRTR1689S
	COOPER TIRE CO.	45840CPRTRLIMAW
	COOPER TIRE CO.	75502CPRTRRT12P
	COPPER TIRE & RUBBER CO. ENGINEERED PRODUCTS DI	71730CPRNDPRESC
	UNIROYAL GOODRICH TIRE CO.	36801NRYLGHIGHW
Utility Boilers - Coke		
	ACME STEEL CO. CHICAGO COKE PLANT	60617CMSTL11236
	ARMCO STEEL CO. L.P. COKE PLANT	41105RMCST4000E
	ARMCO STEEL CO. L.P. MIDDLETOWN PLANT	45043RMCNC1801C
	BETHLEHEM STEEL CORP. BURNS HARBOR PLANT	46304BTHLHBURNS
	BETHLEHEM STEEL CORP. LACKAWANNA COKE DIV.	14218BTHLHPOBOX
	BETHLEHEM STEEL STRUCTURAL PRODS. CORP. METALS	18016BTHLH501EA

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	CITIZENS GAS & COKE UTILITY MFG. DIV.	46203CTZNS2950E
	DRUMMOND CO.INC. ABC COKE DIV. TARRANT COKE PL	35217BCCKDRAILR
	EMPIRE COKE CO.	35404MPRCKENDOF
	ERIE COKE CORP.	16512RCKCRFOOTO
	GENEVA STEEL	84057GNVST1600W
	GRANITE CITY STEEL	62040GRNTC20THS
	GULF STATES STEEL INC.	35904GLFST174SO
	KOPPERS IND. INC. MONESSEN COKE PLANT	15062MNSSN345DO
	KOPPERS IND. INC. WOODWARD COKE PLANT	35061KPPRS2134K
	LTV STEEL CO.	60617LTVST11600
	LTV STEEL CO. INC. PITTSBURGH WORKS	15207PTTSB4650S
	LTV STEEL CO. INC. WARREN COKE PLANT	44482LTVST2234M
	NATIONAL STEEL CORP. GREAT LAKES DIV.	48229GRTLKNO1QU
	NEW BOSTON COKE CORP.	45662NWBST600RI
	SHENANGO INC.	15225SHNNG200NE
	SLOSS INDUSTRIES CORP. BIRMINGHAM FACILITY	35207SLSSN35003
	TONAWANDA COKE CORP.	14150TNWND3875R
	U.S. STEEL USS GARY WORKS	46402SSGRYONENO
	USS CLAIRTON WORKS	15025SSCLR400ST
	WHEELING-PITTSBURGH STEEL CORP STEUBENVILLE EA	26037WHLNGROUTE
Wool Fiberglass Manufacturing		
	CERTAINTEED CORP.	18707CRTNT1220O
	CERTAINTEED CORP.	30613CRTNT425AT
	CERTAINTEED CORP.	66115CRTNT103FU
	CERTAINTEED CORP.	93610CRTNT17775
	GUARDIAN FIBERGLASS INC.	38648GRDNF7046S
	GUARDIAN FIBERGLASS INC.	49224GRDNF1000E
	KNAUF FIBER GLASS	46176KNFFB240EL
	MANVILLE SALES CORP.	30680MNVLLINDUS
	MANVILLE SALES CORP.	43512MNVLLTHIRD
	MANVILLE SALES CORP.	43566MNVLL6050R
	MANVILLE SALES CORP.	91719MNVLL1251M

Appendix D: Facilities Removed from TRI to Avoid Double Counting

112(k) Source Category	Facility Name	TRI ID
	MANVILLE SALES CORP.	95988MNVLLCOUNT
	OWENS CORNING	95050WNSCR960CE
	OWENS-CORNING FIBERGLAS	43055WNSCRCASEA
	OWENS-CORNING FIBERGLAS CORP.	12054WNSCRRT32S
	OWENS-CORNING FIBERGLAS CORP.	30213WNSCR7000M
	OWENS-CORNING FIBERGLAS CORP.	66115WNSCR300SU
	OWENS-CORNING FIBERGLAS CORP.	75165WNSCRHWY35
	SCHULLER INTERNATIONAL INC. PLANT 08	43512MNVLLCARPE
	SCHULLER INTL. INC.	43512MNVLLCOLUM

Appendix E

Allocation Schemes For Section 112(k) Source Categories

Appendix E presents information on how the emissions estimates for each Section 112(k) source category were allocated to urban/rural and major area proportions. Emissions were spatially allocated to U.S. counties using one of the following three general approaches, depending on the data available:

- The national- or state-level emissions estimate was apportioned to individual facilities throughout the U.S. according to facility-specific information such as plant capacity, throughput, etc. Emissions from all facilities in a given county were then summed to determine the county-level emissions for a specific pollutant in a given source category.

- The national- or state-level emissions estimate was apportioned to counties throughout the U.S. using surrogate information such as county SIC Code employment, county population, etc., as specified for a given source category.

- The reported, facility-specific emissions such as those from TRI were summed to determine the county-level emissions for a specific pollutant in a specified source category.

Table E-1 describes the allocation schemes that were used to determine county-level emissions (note that the basis for all of the allocation schemes is outlined by one of the above three general approaches). Table E-2 presents the allocation scheme used for each source category, and indicates the assumed major, area, and mobile source proportions for each source category.

Table E-1.

Description of the Allocation Schemes Used to Spatially Allocate Emissions

Allocation Scheme Code	Basis for Original Emissions Estimate	Allocation Scheme Description[a]
0	Facility-level	Available facility-level emissions data as reported in TRI.
10	National-level	National emissions were allocated to regions based on the regional proportion of national wood consumption. The regional emissions were then allocated to counties based on the county proportion of regional SIC Code employment.
13	National-level	50% of the national emissions were allocated to states based on the state proportion of national SIC Code employment. The remaining 50% of national emissions were distributed evenly among the top 8 states: an additional 6.25% of national emissions were allocated to CA, FL, KY, OH, OK, PA, TX, and VA (8*6.25%=50%). State emissions were then allocated to counties based on the county proportion of state SIC Code employment.
15	National-level	National emissions were allocated to states based on the state proportion of national PCB emissions from the sewage sludge incineration category. State emissions were then allocated to counties based on the county proportion of state population.
17	National-level	National emissions were allocated to counties based on the county proportion of national SIC Code employment.
18	National-level	National emissions were allocated to counties based on the county proportion of national population.
21	National-level	National emissions were allocated to regions based on regional proportion of national wood consumption. Regional emissions were then divided into "urban" and "rural" classifications based on information provided by the Hearth Products Association. Urban and rural regional emissions were then allocated to urban or rural counties based on the county proportion of the regional urban and rural population.
22	National-level	National emissions were allocated to counties according to the county proportion of national emissions. In some cases, the county proportions were determined from facility lists and associated plant capacities, throughput, etc., which were summed for each county to account for multiple facilities in the same county. In other cases, the county proportions were determined from county activity data such as vehicle miles traveled or landings and take-offs.
23	Facility-level	Facility lists were provided and TRI facility identification codes were assigned to each facility. Then, TRI estimates for each facility were assigned to the counties where the facilities are located.

[a] *References to SIC Code employment*: The SIC Code or SIC Code group (e.g., commercial sector) used in the allocation scheme depends on the source category.

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Accident And Health Insurance	0	0	100	0
Acrylic Fibers/Modacrylic Fibers Production	22	75	25	0
Adhesives and Sealants	0	80	20	0
Aerospace Industries	0, 17	96	4	0
Agricultural Chemicals and Pesticides	0	97	3	0
Air and Gas Compressors	0	10	90	0
Air Transportation, Scheduled	0	100	0	0
Aluminum Die-Castings	0	76	24	0
Aluminum Extruded Products	0	89	11	0
Aluminum Foundries	0	0	100	0
Aluminum Foundries (Castings)	0	87	13	0
Aluminum Rolling and Drawing, nec	0	92	8	0
Aluminum Sheet, Plate, and Foil manufacturing	0	100	0	0
Ammunition, Except for Small Arms	0	99	1	0
Analytical Instruments	0	75	25	0
Animal Cremation	17	0	100	0
Apparel and Accessories, nec	0	66	34	0
Architectural Metal Work	0	100	0	0
Asbestos Products Manufacturing	0	2	98	0
Asphalt Concrete Manufacturing	0, 17	0	100	0
Asphalt Roofing Manufacturing	0, 17	88	12	0
Autobody Refinishing Paint Shop	17	25	75	0
Automatic Vending Machines	0	0	100	0
Automotive Services, Nec	0	0	100	0
Automotive stampings	0	82	18	0
Aviation Gasoline Distribution: Stage I & II	18	10	90	0
Bags, Except Textile Bags	0	0	100	0
Ball and Roller Bearings Manufacturing	0	78	22	0
Beet Sugar	0	99	1	0
Biological Products, Except Diagnostic	0	0	100	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Blankbooks and Looseleaf Binders	0	100	0	0
Blast Furnaces and Steel Mills	0	93	7	0
Blowers and Fans	0	93	7	0
Boat Manufacturing	0, 17	90	10	0
Bolts, Nuts, Rivets and Washers Manufacturing	0	99	1	0
Bottled and Canned Soft Drinks	0	0	100	0
Brass, Bronze, Copper, Copper Base Alloy Foundries	0	0	100	0
Brooms and Brushes	0	0	100	0
Burial Caskets	0	94	6	0
Business Services, nec (7399)	0	0	100	0
Buttons	0	0	100	0
Cadmium Refining and Cadmium Oxide Production	22	45	55	0
Cadmium Stabilizers for Plastics	22	100	0	0
Cadmium Stabilizers Production	22	100	0	0
Canned Fruits and Vegetables	0	0	100	0
Carbamate Insecticides Production	22	30	70	0
Carbon and Graphite Products	0	31	69	0
Carbon Black (not subject to MACT)	0	100	0	0
Carbon Black Production	22	30	69	0
Carbon Reactivation Furnaces	13	25	75	0
Carburetors, Pistons, Rings and Valves Manufacturing	0	98	2	0
Cathode Ray Television Picture Tubes Manufacturing	0	97	3	0
Cement, Hydraulic (not subject to Portland Cement MACT)	0	5	95	0
Certified Air Trans	0	100	0	0
Chemical Manufacturing: ABS Resins	22	100	0	0
Chemical Manufacturing: Alkalies and Chlorine (not subject to Chlorine Production MACT)	0	98	2	0
Chemical Manufacturing: Chloroform Production	22	100	0	0
Chemical Manufacturing: Chloroform Production (Storage Emissions)	22	100	0	0
Chemical Manufacturing: Chloromethanes Production	22	100	0	0
Chemical Manufacturing: Chromium Compounds	22	0	100	0
Chemical Manufacturing: Methyl Chloroform	22	100	0	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Chemical Manufacturing: Naphthalene	22	70	30	0
Chemical Manufacturing: Naphthalene Sulfonates	22	70	30	0
Chemical Manufacturing: p-Dichlorobenzene (1,4-)	22	98	2	0
Chemical Manufacturing: p-Dichlorobenzene (Storage Emissions)	22	98	2	0
Chemical Manufacturing: Phenol Manufacturing	22	98	2	0
Chemical Manufacturing: Styrene	22	100	0	0
Chemical Manufacturing: Styrene (Storage Emissions)	22	100	0	0
Chemical Manufacturing: Styrene-Butadiene Copolymer Latexes	22	100	0	0
Chemical Manufacturing: Tetrachloroethylene	22	99	0	0
Chemical Manufacturing: Trichloroethylene	22	100	0	0
Chemical Preparations	0	87	13	0
Chemicals and Allied Products Manufacturing	0	98	2	0
Chemicals and Allied Products, nec	0	0	100	0
Chlorinated Solvents Production	17	100	0	0
Chlorine Production	22	0	100	0
Chromic Acid Anodizing	17	5	95	0
Cigarette Smoke	18	0	100	0
Clay Products Manufacturing	0, 17	87	13	0
Clay Refractories (not subject to Refractories Manufacturing MACT)	0	0	100	0
Coke By-Product Plants	22	100	0	0
Coke Ovens: Emergency Releases	22	100	0	0
Coke Ovens: Charging, Top Side, and Door Leaks	22	100	0	0
Coke Ovens: Pushing, Quenching, and Battery Stacks	22	100	0	0
Cold Finishing of Steel Shapes	0	88	12	0
Commercial Laundry Equipment	0	100	0	0
Commercial Lighting Fixtures	0	61	39	0
Commercial Physical Research	0	0	100	0
Commercial Printing, Letterpress, and Screen	0	76	24	0
Commercial Printing, Lithographic	0	87	13	0
Commercial Sterilization Facilities	23	79	20	0
Communications Equipment, nec	0	95	5	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Computer Terminals	0	0	100	0
Concrete Block and Brick	0	100	0	0
Concrete Products	0	62	38	0
Condensed and Evaporated milk	0	0	100	0
Construction Machinery Manufacturing	0	93	7	0
Consumer Products Usage	18	0	100	0
Conveyors and Conveying Equipment Manufacturing	0	2	98	0
Copper Foundries	0	0	100	0
Copper Rolling and Drawing	0	95	5	0
Creamery Butter	0	0	100	0
Crowns & Closures	0	100	0	0
Crushed And Broken Limestone	0	0	100	0
Custom Compound Purchased Resins Manufacturing	0	60	40	0
Cut Stone and Stone Products	0	0	100	0
Cutlery	0	97	3	0
Cyclic Crude and Intermediate Production (not subject to Petroleum Refining MACT)	0	93	7	0
Decorative Chromium Electroplating	17	5	95	0
Dental Equipment and Supplies	0	0	100	0
Dental Preparation and Use	17	100	0	0
Distilled and Blended Liquors Production	0	100	0	0
Dog and Cat Food	0	0	100	0
Drapery Hardware and Blinds and Shades	0	0	100	0
Drum and Barrel Reclamation	22	0	100	0
Dry Cleaning Facilities	17	0	100	0
Edible Fats and Oils, nec	0	98	2	0
Electric Lamps	0	45	55	0
Electrical Apparatus and Equipment	0	100	0	0
Electrical Equipment and Supplies, nec	0	84	16	0
Electrical Housewares and Fans	0	96	4	0
Electrical Industrial Apparatus, nec	0	94	6	0
Electromedical Equipment Manufacturing	0	80	20	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Electrometallurgical Products Manufacturing	0, 17	95	5	0
Electron Tubes Manufacturing	0	98	2	0
Electronic Capacitors Manufacturing	0	94	6	0
Electronic Coils and Transformers	0	0	100	0
Electronic Components and Accessories	0	76	24	0
Electronic Components, nec	0	86	14	0
Electronic Connectors	0	90	10	0
Electronic Resistors	0	97	3	0
Elevators and Moving Stairways Manufacturing	0	83	17	0
Engine Electric Equipment	0	99	1	0
Engineering, Laboratory, Scientific and Research	0	99	1	0
Environmental Controls Manufacturing	0	78	22	0
Fabric Dress and Work Gloves	0	88	12	0
Fabricated Metal Products Manufacturing	0	97	3	0
Fabricated Metal Products, nec	0	93	7	0
Fabricated Pipe and Fittings	0	90	10	0
Fabricated Plate Work (Boiler Shops)	0	85	15	0
Fabricated Rubber Products Manufacturing	0	0	100	0
Fabricated Rubber Products, nec	0	91	9	0
Fabricated Structural Metal Manufacturing	0	83	17	0
Fabricated Structural Metal Products	0	0	100	0
Fabricated Textile Products, nec	0	33	67	0
Farm Machinery and Equipment Manufacturing	0	46	54	0
Fasteners, Buttons, Needles, and Pins	0	71	29	0
Fertilizers, Mixing only	0	0	100	0
Fiber Cans, Drums, and Similar Products	0	70	30	0
Flat Glass	0	99	1	0
Flavoring Extracts and Syrups Production	0	97	3	0
Flexible Polyurethane Foam Fabrication Operations	17	26	77	0
Flexible Polyurethane Foam Production	22	94	6	0
Fluid Meters and Counting Devices	0	0	100	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Fluid Power Cylinders and Activators	0	0	100	0
Fluid Power Pumps and Motors	0	100	0	0
Fluid Power Valves and Hose Fittings Manufacturing	0	100	0	0
Fluorescent Lamp Recycling	18	20	80	0
Fluorocarbon Production	22	100	0	0
Food and Agricultural Products: Cotton Ginning	22	0	100	0
Food Preparations Production	0	97	3	0
Food Products Machinery	0	98	2	0
Food Products Machinery Manufacturing	0	99	1	0
Footwear Cut Stock	0	79	21	0
Footwear, Except Rubber, nec	0	100	0	0
Formaldehyde, Acrolein, Acetaldehyde, Butyraldehyde Production	22	100	0	0
Friction Products Manufacturing	22	95	5	0
Gaskets, Packing and Sealing Devices	0	100	0	0
Gaskets, Packing and Sealing Devices Manufacturing	0	50	50	0
Gasoline Distribution (Stage 1)	17	5	95	0
Gasoline Distribution Stage II	18	10	90	0
General building contractors	0	0	100	0
General Industrial Machinery Manufacturing	0	85	15	0
General Laboratory Activities	18	20	80	0
Geothermal Power	22	0	100	0
Glass Containers	0	97	3	0
Guided Missiles and Space Vehicles Manufacturing	0	100	0	0
Gum and Wood Chemical Manufacturing	0	99	1	0
Halogenated Solvent Cleaners	17	70	30	0
Hand and Edge Tools Manufacturing	0	86	14	0
Hard Chromium Electroplating	17	5	95	0
Hardware Manufacturing	0	99	1	0
Hardwood Veneer and Plywood	0	0	100	0
Hazardous Waste Incineration	22	100	0	0
Heating Equipment, Except Electric	0	58	42	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Heavy Construction, Nec	0	0	100	0
Highway And Street Construction	0	0	100	0
Hoists, Cranes, and Monorails	0	100	0	0
Hose and Belting and Gaskets and Packing	0	100	0	0
Hospital Sterilizers	17	0	100	0
House Slippers	0	0	100	0
Household Appliances	0	85	15	0
Household Audio and Video Equipment	0	76	24	0
Household Vacuum Cleaners	0	1	99	0
Human Cremation	18	0	100	0
Hydrochloric Acid Production	23	99	2	0
Industrial Boilers	10, 17	84	16	0
Industrial Controls	0	0	100	0
Industrial Furnaces and Ovens	0	0	100	0
Industrial Gases Manufacturing	0	88	12	0
Industrial Inorganic Chemical Manufacturing	0	88	12	0
Industrial Machinery, nec	0	83	17	0
Industrial Organic Chemicals	0	100	0	0
Industrial Organic Chemicals Manufacturing	0	98	2	0
Industrial Patterns	0	0	100	0
Industrial Patterns Packaging machinery	0	0	100	0
Industrial Process Cooling Towers	17	100	0	0
Inorganic Pigments Manufacturing	0, 22	57	43	0
Inorganic Pigments: Cadmium Pigments in Plastics	22	100	0	0
Institutional/Commercial Heating	10, 17, 18	0	101	0
Instrument Manufacturing	17	0	100	0
Instruments to Measure Electricity	0	95	5	0
Integrated Iron and Steel Manufacturing	23	100	0	0
Internal Combustion Engine Manufacturing	0	100	0	0
Iron and Steel Forging	0	53	47	0
Iron and Steel Foundries (not subject to Iron Foundries MACT)	0	0	100	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Iron Foundries	0	88	12	0
Jewelry, Precious Metal	0	83	17	0
Lamp Breakage	18	20	80	0
Large Appliance (Surface Coating)	0	95	5	0
Lawn and Garden Equipment	0	0	100	0
Lead Oxide in Pigments	17	100	0	0
Lead Pencils, Art Goods Manufacturing	0	0	100	0
Leather Goods, nec	0	0	100	0
Leather Tanning and Finishing Operations	23	90	10	0
Lighting Equipment	0	0	100	0
Lime Manufacturing	0, 17	94	6	0
Lubricating Oils and Greases	0	76	24	0
Luggage	0	0	100	0
Machine Tool Accessories	0	90	10	0
Machine tools, Metal Cutting Types	0	96	4	0
Machine tools, Metal Forming Types	0	91	9	0
Magnetic and Optical Recording Media Manufacturing	0	59	41	0
Malt Beverages	0	100	0	0
Manifold Business Forms	0	42	58	0
Manufacturing Industries, nec	0	85	15	0
Marine Vessel Loading Operations	17	100	0	0
Marking Devices	0	56	44	0
Measuring and Controlling Devices, nec	0	0	100	0
Measuring and Dispensing Pumps	0	0	100	0
Meat Packing Plants	0	100	0	0
Mechanical Rubber Goods Manufacturing	0	94	6	0
Medical Waste Incinerators	22	15	85	0
Men's and Boys' Shirts	0	0	100	0
Men's And Boys' Suits And Coats	0	100	0	0
Men's And Boys' Trousers And Slacks	0	0	100	0
Men's and Boys' Work Clothing	0	0	100	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Men's Footwear, Except Athletic	0	80	20	0
Metal Barrels, Drums, and Pails Manufacturing	0	88	12	0
Metal Can (Surface Coating)	0	98	2	0
Metal Cans and Shipping Containers	0	0	100	0
Metal coating and allied services (3479)	0	69	31	0
Metal Coil (Surface Coating)	23	93	7	0
Metal Doors, Sash, and Trim	0	71	29	0
Metal Forgings and Stampings	0	0	100	0
Metal Furniture (Surface Coating)	0	93	7	0
Metal Heat Treating Manufacturing	0	86	14	0
Metal Sanitary Ware Manufacturing	0	0	100	0
Metal Services, nec	0	96	4	0
Metal Stampings Manufacturing	0	88	12	0
Metal Valves	0	6	94	0
Metals Service Centers and Offices	0	100	0	0
Metalworking Machinery	0	0	100	0
Metalworking Machinery, nec	0	0	100	0
Millwork, Plywood, and Structural Members	0	0	100	0
Mineral Wool Manufacturing (not subject to Mineral Wool Production MACT)	0	98	2	0
Mineral Wool Production	22	100	0	0
Mining Machinery Manufacturing	0	1	99	0
Misc. Nonmetallic Mineral Products	0	100	0	0
Miscellaneous Chemical Products (2890)	0	0	100	0
Miscellaneous Fabricated Metal Products	0	88	12	0
Miscellaneous Fabricated Wire Products	0	95	5	0
Miscellaneous Manufactures (3990)	0	100	0	0
Miscellaneous Metal Work	0	90	10	0
Miscellaneous Plastics Products	0	92	8	0
Miscellaneous Plastics Products, nec	0	0	100	0
Miscellaneous Publishing	0	0	100	0
Miscellaneous Transportation Equipment	0	0	100	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Mobile Sources: Non-Road Vehicles and Equipment - Aircraft	18	0	0	100
Mobile Sources: Non-Road Vehicles and Equipment - Commercial Marine Vessels	18	0	0	100
Mobile Sources: Non-Road Vehicles and Equipment - Locomotives	18	0	0	100
Mobile Sources: Non-Road Vehicles and Equipment - Other	18	0	0	100
Mobile Sources: On- Road Vehicles	18	0	0	100
MON	0, 17	97	1	0
Motor and Generators Manufacturing	0	71	29	0
Motor Vehicle Equipment	0	99	1	0
Municipal Landfills	18	10	90	0
Municipal Waste Combustors	22	95	5	0
Naphthalene: Miscellaneous Uses	17	30	70	0
National Security	0	100	0	0
Natural Gas Transmissions and Storage	17	20	80	0
Needles, Pins, Hooks and Eyes and Similar Notions	0	100	0	0
Nitrogenous Fertilizers	0	98	2	0
Non-Vehicular IC Engines	0	100	0	0
Nonclay Refractories (not subject to Refractories Manufacturing MACT)	0	0	100	0
Noncurrent-Carrying Wiring Devices	0	98	2	0
Nonferrous Die-castings, Except Aluminum	0	51	49	0
Nonferrous Forgings	0	85	15	0
Nonferrous Foundries, nec	0	87	13	0
Nonferrous Rolling and Drawing	0	96	4	0
Nonferrous Wire Drawing and Insulating	0	83	17	0
Nonmetallic Mineral Products Manufacturing	0	0	100	0
Nutritional Yeast Manufacturing	22	92	8	0
Oil and Gas Field Machinery Manufacturing	0	11	89	0
Oil and Natural Gas Production	17	65	35	0
Open Burning: Scrap Tires	18	0	100	0
Open Burning: Forest and Wildfires	22	0	100	0
Open Burning: Prescribed Burnings	22	0	100	0
Ophthalmic Goods	0	96	4	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Optical Instruments and Lenses	0	85	15	0
Optical instruments and lenses (disc. 1987, 3827)	0	0	100	0
Ordnance and Accessories Manufacturing	0	100	0	0
Ordnance And Accessories, nec	0	0	100	0
Other Cadmium Compound Production	22	45	55	0
Paints and Allied Products Manufacturing	0	61	39	0
Paper And Allied Products	0	27	73	0
Paper and Other Webs (Surface Coating)	0	95	5	0
Paper Coating and Glazing Manufacturing	0	51	49	0
Paper Industries Machinery	0	23	77	0
Paper Mills (not subject to Pulp and Paper MACT)	0	93	7	0
Paperboard Mills	0	86	14	0
Particleboard	0	99	1	0
Partitions And Fixtures	0	0	100	0
Pens and Mechanical Pencils	0	100	0	0
Pesticide Application	18	0	100	0
Pesticide Manufacture	17	0	100	0
Petroleum Bulk Stations and Terminals (not subject to Petroleum Refining MACT)	0	89	11	0
Petroleum Products, nec	0	0	100	0
Petroleum Refineries: Catalytic Cracking (Fluid and other) Units, Catalytic Reforming Units, and Sulfur Plant Units	17	100	0	0
Petroleum Refineries: Other Sources Not Distinctly Listed	22	98	2	0
Petroleum Refining (not subject to Petroleum Refining MACT)	0	97	3	0
Pharmaceuticals Production	0, 17	97	3	0
Phosphate Fertilizers Production	0	0	100	0
Photographic Equipment And Supplies	0	100	0	0
Phthalic Anhydride Production	22	70	30	0
Plastic Parts and Products (Surface Coating)	0, 23	95	5	0
Plastics Foam Products Manufacturing (not subject to Plastic Parts (Surface Coating) MACT)	0	100	0	0
Plastics Pipe	0	100	0	0
Plastics Products Inc. Plastic Bottles	0	0	100	0
Platemaking Services	0	0	100	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Plating And Polishing	0	86	14	0
Plumbing And Heating, Except Electric	0	0	100	0
Plumbing Fixture Fittings and Trim	0	89	11	0
Plumbing, Heating, Air-conditioning	0	100	0	0
Plywood/Particle Board Manufacturing	23	98	3	0
Polishes and Sanitation Goods Manufacturing	0	48	52	0
Polycarbonates Production	22	100	0	0
Polyether Polyols Production	17	90	10	0
Polymers & Resins (I, II, and IV)	0	97	3	0
Polymers & Resins III	22	100	0	0
Polystyrene Production	22	100	0	0
Polyvinyl Chloride and Copolymers Production	17	95	5	0
Portland Cement, excluding hazardous waste-fired	22	90	10	0
Potato Chips and Similar Snacks	0	100	0	0
Poultry Slaughtering and Processing	0	0	100	0
Power Driven Handtools	0	99	1	0
Power Transmission Equipment	0	97	3	0
Prefabricated Metal Buildings	0	91	9	0
Prepared Feeds Manufacturing	0	0	100	0
Pressed and Blown Glass and Glassware Manufacturing	0	87	13	0
Primary Aluminum Production	0, 17	100	0	0
Primary Battery, Dry and Wet Manufacture	0, 17	98	2	0
Primary Copper (not subject to Primary Copper Smelting MACT)	0	0	100	0
Primary Copper Smelting	22	73	27	0
Primary Lead Smelting	22, 23	100	0	0
Primary Metal Products Manufacturing	0	56	44	0
Primary Nonferrous Metals Production	0	96	4	0
Primary Smelting and Refining of Zinc	0	0	100	0
Printing Ink	0	41	59	0
Printing Trades Machinery Manufacturing	0	100	0	0
Printing, Coating, and Dyeing of Fabrics	0	95	5	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Printing/Publishing (Surface Coating)	0	73	27	0
Process Control Instruments	0	92	8	0
Products of Purchased Glass	0	95	5	0
Publicly Owned Treatment Works (POTW) Emissions	18	4	96	0
Pulp and Paper Production (combustion) MACT II	22	100	0	0
Pulp and Paper Production (non-combustion) MACT I	22	100	0	0
Pulp mills (not subject to Pulp and Paper MACT)	0	100	0	0
Pumps and Pumping Equipment Manufacturing	0	1	99	0
Radio and Television Communications Equipment (3662)	0	32	68	0
Radio and Television Communications Equipment (3663)	0	3	97	0
Railroad Equipment Manufacturing	0	83	17	0
Reconstituted Wood Products	0	88	12	0
Refractories Manufacturing	22	85	15	0
Refuse Systems	0	0	100	0
Reinforced Plastic Composites Production	23	87	13	0
Relays and Industrial Controls	0	80	20	0
Rental Of Railroad Cars	0	100	0	0
Residential Heating: Wood/Wood Residue Combustion	21	0	100	0
Residential Heating: Anthracite Coal Combustion	18	0	100	0
Residential Heating: Bituminous and Lignite Coal Combustion	18	0	100	0
Residential Heating: Distillate Oil Combustion	18	0	100	0
Residential Heating: Natural Gas Combustion	18	0	100	0
Residential lighting fixtures	0	94	6	0
Robes and Dressing Gowns	0	0	100	0
Rolling Mill Machinery	0	100	0	0
Roofing, Siding, And Sheet Metal Work	0	0	100	0
Rubber & Misc. Plastic Products	0	0	100	0
Rubber and Plastic Footwear	0	0	100	0
Rubber and Plastic Footwear Manufacturing	0	0	100	0
Rubber and Plastic Hose and Belting	0	100	0	0
Rubber and Plastic Hose and Belting Manufacturing	0	98	2	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Sanitary Food Containers	0	0	100	0
Saw Blades and Handsaws	0	100	0	0
Sawmills and Planing Mills, general	0	0	100	0
Scrap Tire Combustion	22	100	0	0
Screw Machine Products Manufacturing	0	69	31	0
Search and Navigation Equipment	0	85	15	0
Secondary Aluminum Smelting	17	100	0	0
Secondary Copper	17	45	55	0
Secondary Lead Smelting	22	92	8	0
Secondary Mercury Production	22	50	50	0
Secondary Nonferrous Metals	0	100	0	0
Secondary Nonferrous Metals Production	0	78	22	0
Secondary Zinc Production	22	45	55	0
Semiconductor Manufacturing	0	89	11	0
Sewage Sludge Incineration	22	0	100	0
Sheet Metal Work	0	89	11	0
Ship and Boat Building (not subject to Boats Manufacturing MACT)	0	88	12	0
Shipbuilding and Ship Repair (Surface Coating)	23	98	2	0
Silverware and Plated Ware	0	95	5	0
Small Arms	0	95	5	0
Small Arms Ammunition	0	100	0	0
Soap and Other Detergents Manufacturing	0	73	27	0
Soaps, Cleaners, and Toilet Goods	0	0	100	0
Softwood Drying Kilns	17	0	100	0
Softwood Veneer and Plywood	0	0	100	0
Space Propulsion Units and Parts Manufacturing	0	100	0	0
Space Research and Technology	0	0	100	0
Space Vehicle Parts and Equipment, nec	0	87	13	0
Spandex Production	22	100	0	0
Special Dies, Tools, Jigs and Fixtures	0	0	100	0
Special Industry Machinery Manufacturing	0	100	0	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Special Industry Machinery, nec	0	90	10	0
Special Trade Contractors, nec	0	0	100	0
Speed Changers, Drives, and Gears	0	91	9	0
Stainless and Non-stainless Steel Manufacture - EAF	23	90	10	0
Stationary Combustion Turbines	17	50	50	0
Stationary Internal Combustion Engines	17	60	40	0
Steel and Iron Reclamation- Auto Scrap Burning	0	0	100	0
Steel Foundries	0	77	23	0
Steel Pipe and Tubes Manufacturing	0	98	2	0
Steel Springs, Except Wire	0	100	0	0
Steel Wire and Related Products Manufacturing	0	96	4	0
Storage Batteries Manufacturing	0	26	74	0
Structure Fires	18	0	100	0
Surface Active Agents Manufacturing	0	89	11	0
Surgical and Medical Instruments Manufacturing	0	97	3	0
Surgical Appliances and Supplies Manufacturing	0	47	53	0
Switchgear and Switchboard Apparatus	0	78	22	0
Taconite Iron Ore Processing	22	45	55	0
Tanks and Tank Components Manufacturing	0	92	8	0
Telephone and Telegraph Apparatus	0	95	5	0
Textile Machinery	0	2	98	0
Tire Cord And Fabrics	0	77	23	0
Tire Production	22	99	1	0
Tires and Inner Tubes (not subject to Tire Production MACT)	0	0	100	0
Toilet Preparations Manufacturing	0	0	100	0
Toys and Sporting Goods	0	0	100	0
Transformers, Except Electronic	0	98	2	0
Transmitting, Industrial and Special Purpose Elect	0	0	100	0
Transportation Equipment	0	100	0	0
Travel Trailers and Campers Manufacturing	0	100	0	0
Trucking, Except Local	0	0	100	0

Table E-2: Major/Area/Mobile Breakdown for 112(k) Source Categories

112(k) Source Category	Allocation Code	Major Percent	Area Percent	Mobile Percent
Turbines and Turbine Generator Sets	0	20	80	0
Typewriters Computer Storage Devices	0	100	0	0
Unsupported Plastics Film & Sheet	0	96	4	0
Unsupported Plastics Profile Shapes	0	0	100	0
Upholstered Household Furniture	0	100	0	0
Uranium Hexafluoride Production	23	0	100	0
Utility Boilers - Coal	22	100	0	0
Utility Boilers - Coke	22	100	0	0
Utility Boilers - Natural Gas	22	0	100	0
Utility Boilers - Oil	22	70	30	0
Valves and Pipe Fittings Manufacturing	0	73	27	0
Vegetable Oil Mills, nec	0	0	100	0
Vegetable Oil Production	23	100	0	0
Watches, Clocks, Watchcases, and Parts	0	100	0	0
Water, Sewer, and Utility Lines	0	0	100	0
Welding Apparatus	0	81	19	0
Welding Apparatus, Electric	0	3	97	0
Wet Corn Milling	0	91	9	0
Wire Springs	0	99	1	0
Women's Footwear, Except Athletic	0	100	0	0
Wood Building Products (Surface Coating)	0	81	19	0
Wood Furniture (Surface Coating)	0	93	7	0
Wood Partitions and Fixtures	0	94	6	0
Wood Preserving	0, 17	9	91	0
Wood Products	0	99	1	0
Wool Fiberglass Manufacturing	22	99	1	0
X-ray Apparatus and Tubes	0	0	100	0